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National Aeronautics and Space Administration

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N65-23370# Boeing Scientific Research Labs., Seattle, Wash.
OBSTACLE-INDUCED FLOW RECIRCULATION
G. K. Timm Mar. 1965 74 p refs *Its* Flight Sci. Lab. Rept. No. 94
(DI-82-0423)

The results of a series of tests studying obstacle-induced flow recirculation are presented. A small-scale rotor creates a slipstream which impinges on a ground plane and then encounters an obstacle. The principal test technique is that of flow visualization using sawdust particles, but in addition some power measurements are made. Author

N65-23507 Joint Publications Research Service, Washington, D. C.
ON THE CALCULATION OF NONSTATIONARY FORCES IN A BLADING LATTICE
V. P. Vakhomchik *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 86–98 refs (See N65-23500 13-01) CFSTI: $6.00

This paper determines in the general form the aerodynamic lifting force and the moment arising during nonstationary flow through a blading lattice with stagger γ consisting of thin, slightly cambered profiles of an ideal incompressible fluid. A solution in closed form is obtained, using the method of separation of the singularities at the points (b_1, b_2) by means of the function (the stagger angle γ is measured from the plane of the front of the blading to the normal to the profile chord). Author

N65-23516 Joint Publications Research Service, Washington, D. C.
ON THE FUNDAMENTAL SOLUTION OF THE PROBLEM OF THE FLOW AROUND A SYMMETRIC WING IN A LONGITUDINAL MAGNETIC FIELD
V. A. Rykov *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 214–219 refs (See N65-23500 13-01) CFSTI: $6.00

Uniform flow about a symmetrical wing of small thickness ratio in the presence of uniform longitudinal magnetic field is studied theoretically. In presenting a linear approximation to the problem, a system of differential equations is given which describes the two-dimensional motion of a compressible gas with constant conductivity. Boundary conditions are stated which facilitate integration of the equations. The integral form is the fundamental solution, and it constitutes an influence function which can be used to study the behavior of particular solutions for the flow about the symmetrical profile. An asymptotic approximation to the fundamental solution is developed, and investigation of it reveals that there is both an upstream and a downstream wake in the flow field. J.M.D.

N65-23538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANICS AND MACHINE CONSTRUCTION Selected Articles
5 Jun. 1963 34 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 6, 1962 p 33–49
(FTD-TT-63-375/1+2+4; AD-413581)

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N65-23539 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPERSONIC FLOW PAST A FLAT TRIANGULAR PLATE
D. A. Mel'nikov *In its* Mech. and Machine Construct. 5 Jun. 1963 p 1–11 refs (See N65-23538 13-01)

Examined is the flow past a flat triangular plate on the compression side with angles of attack at which the supersonic component of the velocity vector of an unperturbed flow, normal to the leading edge of the plate, meets the plate at an angle less than the limiting angle of the corresponding wedge. Author

N65-23540 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PROPERTIES OF SUPERSONIC FLOW IN THE INITIAL SECTION OF A GAS EJECTOR
A. Ya. Cherkez *In its* Mech. and Machine Construct. 5 Jun. 1963 p 12–32 refs (See N65-23538 13-01)

A number of peculiarities of flow in the initial section of a gas ejector having supercritical ratios of the pressures of the mixing gases are studied conceptually. A theoretical method previously explained and applied to study of nonrated gas jets is used in calculating flow parameters. The following conclusions are developed: The area of the maximum cross section of a supersonic jet flowing from a nonexpanded nozzle will be smaller than the area of the discharge cross section of a Laval nozzle. The area of the maximum cross section of the first barrel of a nonrated supersonic jet decreases if there is an increase in the force acting on the gas at the boundaries of the jet in the direction of movement. Optimum values of the nozzle

expansion ratio coincide with the regularity in change in optimum area, depending on parameters and discharges of the mixing gases. The area of the maximum cross section of a free jet choking the mixing chamber is larger than the area of the discharge cross section of a Laval nozzle in which there is no overexpansion of the flow. J.M.D.

N65-23610# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS OF THEORETICAL AND EXPERIMENTAL DATA ON THE LIFT OF WINGS WITH PARALLEL TIPS AT SUPERSONIC SPEEDS
A. Stanbrook London, Min. of Supply, Jun. 1951 53 p refs (RAE-TN-AERO-2105) (Declassified)

All available experimental data on the lift at supersonic speeds of wings with straight line planforms and parallel tips were summarized and compared with theory. The results indicate that the similarity law forms a satisfactory basis for comparison and that, on the average, the linear theory over estimates lift-curve slope by about 8%. Charts for design use are given, and, for completeness, the variations at subsonic speeds are included. Author

N65-23689*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC FORCE AND MOMENT CHARACTERISTICS OF SPHERES AND CONES AT MACH 7.0 IN METHANE-AIR COMBUSTION PRODUCTS
L. Roane Hunt Washington, NASA, May 1965 28 p refs (NASA-TN-D-2801) CFSTI: HC $2.00/MF $0.50

An investigation was conducted in the 7-inch Mach 7 pilot tunnel to establish the validity of aerodynamic forces measured in a test medium composed of the combustion products of a methane-air reaction. The results, which include the drag characteristics of spheres, the longitudinal characteristics of sharp and blunt slender cones, and the center-of-pressure locations for these cones, are compared with results obtained from similar configurations tested in air and helium mediums. The data, presented in the form of aerodynamic force-and-moment coefficients, agree with results obtained in air and helium in both the general trend and the magnitude. Also, normal-force and pitching-moment correlation factors derived from Newtonian flow theory are found to be adequate for predicting results. Author

N65-23690*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ZERO-LIFT DRAG AT MACH 1.42, 1.83, AND 2.21 OF A SERIES OF WINGS WITH VARIATIONS OF THICKNESS RATIO AND CHORD
Barrett L. Shrout Washington, NASA, May 1965 21 p refs (NASA-TN-D-2811) CFSTI: HC $1.00/MF $0.50

A series of wing configurations having various spanwise distributions of chord and thickness ratio but having the same effective thickness ratio was subjected to both a theoretical and experimental investigation of the zero-lift drag characteristics in the Mach number range from 1.2 to 2.2. Semispan models of the wings were tested in the Langley 4- by 4-foot supersonic pressure tunnel at Mach numbers of 1.42, 1.83, and 2.21 and a Reynolds number per foot of 4.3×10^6. Results of this experimental investigation were in good agreement with the theoretical data, and indicate that the chord and thickness distributions may be arranged in such a manner as to provide higher wing volume without a wave drag penalty. An extension of the theoretical analysis indicated that the wave drag of a wing can be significantly affected by relatively minor changes in planform. Author

N65-23774 Aeronautical Research Council (Gt. Brit.)
NON-LINEAR THEORY OF STEADY FORCES ON WINGS WITH LEADING-EDGE FLOW SEPARATION
H. C. Garner and Doris E. Lehrian London, HMSO, 1964 68 p refs Supersedes NPL-AERO-1059; ARC-24523 (ARC-R&M-3375; NPL-AERO-1059; ARC-24523) HMSO: £1 6s

A simplified mathematical vortex model for wings in steady incompressible flow, in conjunction with a linear lifting-surface theory, provides the basis of the present method. The investigation covers a variety of planforms, and each type illustrates different facets of nonlinear theory and its numerical application. Comparisons between calculated results and wind-tunnel measurements are used in appraising the method. When there are leading-edge vortexes or extensive regions of separated flow, the calculated total lift and pitching moment give a decisive improvement on linear theory. Analysis shows a simple correlation between the center of nonlinear lift and the linear aerodynamic center. The spanwise distributions of lift and local center of pressure on rectangular wings are well predicted, but the calculated loading on swept wings appears to be unrealistic. An alternative treatment of the mathematical model on the basis of slender-wing theory illustrates some defects of the method in its present form. However, the method's reliability for steady aerodynamic forces appears to justify immediate extension to the oscillatory problem of slowly pitching wings of arbitrary planform at high mean incidence. Author

N65-23826*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LARGE-SCALE WIND-TUNNEL INVESTIGATION OF THE LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A SUPERSONIC TRANSPORT MODEL HAVING VARIABLE-SWEEP WINGS
Anthony M. Cook, Richard K. Greif, and Kiyoshi Aoyagi May 1965 126 p refs
(NASA-TN-D-2824) CFSTI: HC $4.00/MF $1.00

Results are presented as six-component aerodynamic force and moment data obtained at various angles of attack and sideslip. Data were obtained at a Reynolds number of 16 million, based upon the mean aerodynamic chord of the wing swept to 75°. The investigation included variations of wing sweepback and aspect ratio, leading-edge slat deflection and geometry, trailing-edge flap deflection, geometry, and span extent, and horizontal-tail geometry. The results show that all configurations tested, except one, were longitudinally unstable at high lift. The configuration that was not unstable had a tail in a low horizontal position, a wing sweepback angle of 25° with a large portion of the fixed wing deflected as a leading-edge flap. Author

N65-23827*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDY OF THE STABILITY AND DRAG AT MACH NUMBERS FROM 4.5 TO 13.5 OF A CONICAL VENUS ENTRY BODY
Peter F. Intrieri May 1965 50 p refs
(NASA-TN-D-2827) HC $2.00/MF $0.50

The study was conducted in a gas mixture of 9% carbon dioxide and 91% nitrogen, and in air at Mach 4.5, 9.0, and 13.5 and Reynolds numbers from 0.4 to 1.2 million. For the assumed center-of-gravity location, the configuration was determined statically and dynamically stable at all Mach numbers and throughout the angle-of-attack range. It exhibits the same static stability, dynamic stability, and drag in air as in nitrogen–carbon dioxide. The static stability is invariant with Mach number and nonlinear with angle of attack. The nonlinear variation

of pitching moment with angle of attack was closely approximated by a two-term power series of the resultant angle of attack. The dynamic stability is invariant with Mach number and angle of attack. The drag coefficient of the configuration is essentially invariant with Mach number and increases with increasing angle of attack. Evidence presented shows that the configuration is statically stable only about a nose-forward trim attitude of zero angle of attack and dynamically stable about this unique stable attitude for all amplitudes of oscillation. Author

N65-23916*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A WIND-TUNNEL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF BODIES OF REVOLUTION AT MACH NUMBERS OF 2.37, 2.98, AND 3.90 AT ANGLES OF ATTACK TO 90°

Fred M. Smith Washington, NASA, Aug. 1960 36 p refs (NASA-TM-X-311) CFSTI: HC $2.00/MF $0.50

The investigation was made to determine the effects on the high-angle aerodynamic characteristics produced by blunting a pointed ogival nose to hemispherical, by changing the face shape of a cylindrical nose from concave hemispherical to convex hemispherical, and by adding afterbodies of several lengths to the noses. Results indicate that the force and stability characteristics were more dependent upon the planform area and area distribution than upon the particular shape or bluntness of the noses. The cross-flow drag theory, used to correlate the experimental normal-force data, accounted for angle of attack and stream Mach number for the tests of a flat-face circular cylinder. In comparisons of the experimental results with the results from several variations of Newtonian impact theory, the unmodified theory most accurately (not satisfactorily) predicted the experimental results. Author

N65-23917*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STATIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS AT A MACH NUMBER OF 2.01 OF A HYPERSONIC MISSILE CONFIGURATION HAVING ALL-MOVABLE WING AND TAIL SURFACES

Ross B. Robinson and Gerald V. Foster Washington, NASA, Apr. 1961 29 p refs (NASA-TM-X-516) CFSTI: HC $2.00/MF $0.50 (Declassified)

Effects of deflecting the wing and tail surfaces individually and in combination were determined for an angle-of-attack range of about −1° to 27°. A limited amount of roll control data was also obtained. The investigation was made in a 4 ft by 4 foot supersonic pressure tunnel at a Reynolds number of about 7.42×10^6 based on the model length. Deflections of the wing and tail controls in combination provided the highest trim values of angle of attack and normal force, but at the cost of high values of drag. The highest values of trim lift–drag ratio were obtained using the tail controls alone. Differential deflection of the vertical tails provided a suitable means of roll control, whereas differential deflection of the vertical wings was less desirable because of a nonlinear variation of rolling moment with angle of attack and a large adverse yawing moment. Author

N65-23918*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LOW-SPEED INVESTIGATION OF HIGH-LIFT AND LATERAL CONTROL DEVICES ON A SEMISPAN VARIABLE-SWEEP WING HAVING AN OUTBOARD PIVOT LOCATION

William P. Henderson and Alexander D. Hammond Washington, NASA, May 1961 39 p refs (NASA-TM-X-542) CFSTI: HC $2.00/MF $0.50 (Declassified)

The results of a wind-tunnel investigation at low speed to determine the effect of leading-edge- and trailing-edge-flap deflections and spoiler-slot-deflector projections on the high-lift and lateral control characteristics of a semispan variable-sweep-wing configuration are presented. The high-lift devices consist of three types of trailing-edge flaps, a single-slotted flap, a double-slotted flap, and a spoiler-slot-deflector high-lift device, each in conjunction with a leading-edge flap. The lateral control characteristics were obtained by the use of spoiler-slot-deflector projections on both the wing with flaps deflected and with the flaps neutral. Author

N65-23919*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A WINGED AND A FLARED HYPERSONIC MISSILE CONFIGURATION WITH VARIOUS NOSE SHAPES AND FLARE MODIFICATIONS AT A MACH NUMBER OF 2.01

M. Leroy Spearman and Ross B. Robinson Washington, NASA, Jun. 1962 29 p refs (NASA-TM-X-693) CFSTI: HC $2.00/MF $0.50 (Declassified)

An investigation was conducted at Mach 2.01 to determine the longitudinal stability and control characteristics of a winged and a flared hypersonic missile configuration with various nose shapes and flare modifications. The results indicated a progressive increase in longitudinal stability for the flared configuration as the afterbody flare angle was increased; however, there was a substantial increase in axial force. The addition of small fins to a flared afterbody also provided an increase in longitudinal stability with only a little increase in axial force. Progressively varying the nose shape from an ogive to a hemisphere had no unusual effect on the control characteristics of the missiles, but did cause a general decrease in longitudinal stability and an increase in axial force. The addition of a spike to the nose considerably reduced the increase in axial force due to blunting. Author

N65-23920*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

AERODYNAMIC FORCES ON COMPONENTS OF THE X-15 AIRPLANE

Earl R. Keener and Chris Pembo Washington, NASA, Mar. 1962 12 p refs (NASA-TM-X-712) CFSTI: HC $1.00/MF $0.50 (Declassified)

Aerodynamic force data on the components of the X-15 airplane were obtained by both pressure and strain-gage measurements in flights covering a Mach range up to 6.04, altitudes up to about 217 000 feet, and angles-of-attack up to 15°. Comparison of the flight data with wind-tunnel data shows generally good agreement for the flight conditions covered. Author

N65-23921*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

COMPARISON OF FULL-SCALE LIFT AND DRAG CHARACTERISTICS OF THE X-15 AIRPLANE WITH WIND-TUNNEL RESULTS AND THEORY

Edward J. Hopkins, David E. Fetterman, Jr. (NASA, Langley Res. Center), and Edwin J. Saltzman (NASA, Flight Res. Center) Washington, NASA, Mar. 1962 18 p refs (NASA-TM-X-713) CFSTI: HC $1.00/MF $0.50 (Declassified)

A comparison is made between the minimum drag of the X-15 as measured in flight and the minimum drag of an X-15 wind-tunnel model extrapolated to flight Reynolds numbers. In addition, the trimmed lift and drag-due-to-lift characteristics, obtained from wind-tunnel model tests, are shown to be in agreement with full-scale results for Mach numbers up to about

5. Existing theoretical methods are indicated adequate for estimating the X-15 minimum drag but underestimated the drag due to lift and overestimated the maximum lift–drag ratio. Two-dimensional theory is shown adequate for predicting the base pressures behind surfaces having very blunt trailing edges, such as those on the vertical tail of the X-15. Author

N65-23922*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
STABILITY AND CONTROL DERIVATIVE CHARACTERISTICS OF THE X-15 AIRPLANE
Harold J. Walker and Chester H. Wolowicz Washington, NASA, Mar. 1962 31 p refs
(NASA-TM-X-714) CFSTI: HC $2.00/MF $0.50 (Declassified)

Flight measurements of the stability and control derivative characteristics were made up to Mach numbers approaching the design limit (6.0) of the X-15 airplane and to angles-of-attack as high as 17°. These data are, with minor exceptions, in generally good agreement with the predictions from wind-tunnel tests and theory. No adverse longitudinal characteristics were uncovered; however, an area of reduced lateral directional stability and poor lateral directional control was observed at moderate angles-of-attack due to a positive trend in the dihedral derivative for Mach numbers above approximately 2.2. Author

N65-23925*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A 0.02-SCALE MODEL OF THE X-15 AIRPLANE AT MACH NUMBERS OF 2.96, 3.96, AND 4.65 AT HIGH ANGLES OF ATTACK
Royce L. Mc Kinney and Julia A. Lancaster Washington, NASA, Jun. 1963 192 p refs
(NASA-TM-X-820) CFSTI: HC $5.00/MF $1.25 (Declassified)

An investigation was made in a wind tunnel to determine the longitudinal and lateral aerodynamic characteristics of a 0.02-scale model of the X-15 airplane at angles-of-attack from −5° to 45°. The investigation was made at Mach 2.96, 3.96, and 4.65 at Reynolds numbers, based on the wing mean geometric chord, of 0.55×10^6, 0.60×10^6, and 0.84×10^6, respectively. Results are presented and summarized with only a limited analysis. Author

N65-23955# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
PRELIMINARY NOTE ON THE RESULTS OF THE WIND-TUNNEL TESTS ON BUFFET PRESSURES ON THE ELDO SLV
Jul. 1964 12 p
(FF-15)

Measurements of the fluctuating pressures behind the forward shoulder of an ELDO satellite launching vehicle model were made in wind tunnel tests. Most runs were made at the highest possible stagnation pressure and all runs have been made with free transition. The RMS-values of these pressures are presented in tables for cone angles at 40° and 60° G.G.

N65-24001# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
FORCE AND MOMENT TEST ON A 1/40TH SCALE MODEL OF THE ELDO SATELLITE LAUNCHING VEHICLE IN THE NLR SUBSONIC AND TRANSONIC WINDTUNNEL HST
B. M. Spee 13 Jan. 1964 74 p refs
(T-88)

Six-component force and moment measurements were made on a 1/40th-scale model of the vehicle at Mach 0.35 to 1.30, body incidences up to 12° and roll angles between −90° and +90, to check the static stability characteristics in the transonic speed range. Results, free from serious irregularities, show that the largest destabilizing pitching moment occurs at a roll angle of 0° due to the orientation of the first-stage engine pods. The influences of third-stage antennas, satellite-fairing shoulder radius and boundary-layer transition strip are small. The rolling moments are small. Author

N65-24057*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION AT A MACH NUMBER OF 2.01 OF THE AERODYNAMIC CHARACTERISTICS IN COMBINED ANGLES OF ATTACK AND SIDESLIP OF SEVERAL HYPERSONIC MISSILE CONFIGURATIONS WITH VARIOUS CANARD CONTROLS
Ross B. Robinson Washington, NACA, 10 Mar. 1958 35 p refs
(NACA-RM-L58A21) CFSTI: HC $2.00/MF $0.50 (Declassified)

The angle-of-attack ranged from 0° to about 28° at sideslip angles of about 0° and 4°. The configurations tested on the 4-ft by 4-ft supersonic pressure tunnel were a body alone which had a ratio of length to diameter of 10, the body with a 10° flare, the body with cruciform fins of 5° or 15° apex angle, and a flare-stabilized rocket model with a modified Von Kármán nose. Various canard surfaces for pitch control only were tested on the body with the 10° flare and on the body with both sets of fins. The results indicated that the addition of a flared afterbody or cruciform fins produced configurations longitudinally and directionally stable. The body with 5° fins should be capable of producing higher normal accelerations than the flared body. All canard surfaces were effective longitudinal controls which produced net positive increments of normal force and pitching moments which progressively decreased with increasing angle-of-attack. Author

N65-24059*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL STUDIES AT SUBSONIC AND TRANSONIC SPEEDS OF A MULTIPLE-MISSION VARIABLE-WING-SWEEP AIRPLANE CONFIGURATION
William J. Alford, Jr., Arvo A. Luoma, and William P. Henderson Washington, NASA, Nov. 1959 74 p refs
(NASA-TM-X-206) CFSTI: HC $3.00/MF $0.75 (Declassified)

Wind-tunnel studies were made to determine the aerodynamic characteristics of a variable-wing-sweep airplane configuration capable of performing multiple missions. The tests covered Mach range from 0.25 to 1.30 for the 75° wing-sweep condition, but for other sweep angles were limited to Mach 0.93. It was found that at subsonic speeds the longitudinal stability characteristics were essentially the same for both 25° and 75° of wing leading-edge sweep with no wing translation necessary and that the longitudinal control was adequate. There was a slight degree of instability at the higher lift coefficients which, however, does appear tolerable. The transonic aerodynamic-center shift was rather large and appears to be the most important aerodynamic problem. The lateral and directional stability and control appear satisfactory except possibly the lateral control in the low-sweep condition where the damping is high. For this condition it may be necessary to augment the roll control tail with wing-tip ailerons. Author

N65-24060*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
THEORETICAL STABILITY DERIVATIVES FOR THE X-15 RESEARCH AIRPLANE AT SUPERSONIC AND HYPERSONIC SPEEDS INCLUDING A COMPARISON WITH WIND-TUNNEL RESULTS
Harold J. Walker and Chester H. Wolowicz Washington, NASA, Aug. 1960 116 p refs
(NASA-TM-X-287) CFSTI: HC $3.00/MF $0.75 (Declassified)

Calculations are made for Mach numbers within and beyond the estimated flight envelope and for angles-of-attack from 0° to 25°. The results are compared with experimental data in the Mach number range from 2 to approximately 7 and, for the static derivatives, with the limiting values given by Newtonian theory. Good approximations of the longitudinal and lateral–directional derivatives are obtained when attention is given to the shock- and vortex-interference effects between the various airplane components and to the increasing nonlinearity of the aerodynamic coefficients as hypersonic speeds are approached. The characteristics of the lifting surfaces are calculated by the modified hypersonic small-disturbance theory proposed by Van Dyke, and those for the fuselage, by the second-order shock-expansion method. The results of these methods are subsequently employed in conjunction with slender-body and linear theory for calculation of the static and rotary derivatives. The lateral–directional derivatives, although limited to small sideslip angles, are determined for combined sideslip and angle-of-attack. The results of the analysis indicate that the X-15 airplane is statically stable in pitch and yaw to Mach numbers well in excess of its design limits, and that the degree of stability increases substantially with increasing angle-of-attack at hypersonic speeds. The results from simple Newtonian theory in general are substantially lower than the trends indicated by the hypersonic small-disturbance and shock-expansion methods. Author

N65-24076# ARO, Inc., Arnold Air Force Station, Tenn.
DYNAMIC STABILITY CHARACTERISTICS OF A 10-DEG CONE AT MACH NUMBER 20
R. H. Urban and R. J. Shanahan (ARL) Arnold Eng. Develop. Center, Apr. 1965 24 p refs
(Contract AF 40(600)-1000)
(AEDC-TR-65-80; AD-461260)

Tests were conducted in a 30-inch hypersonic tunnel to determine the effects of Reynolds number and frequency of oscillation on the damping-in-pitch derivatives of a 10° half-angle cone. Free oscillation data were obtained at a nominal Mach number of 20, at Reynolds numbers, based on model base diameter, from 50 000 to 100 000, and at model oscillation frequencies from 8 to 45 cps. Test results are presented, and comparisons are made with modified Newtonian impact theory and an unsteady flow-field theory. Author

N65-24100*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPLORATORY INVESTIGATION OF THE LOW-SPEED AERODYNAMIC CHARACTERISTICS OF VARIABLE-WING-SWEEP AIRPLANE CONFIGURATIONS
William J. Alford, Jr. and William P. Henderson Washington, NASA, Sep. 1959 24 p refs
(NASA-TM-X-142) CFSTI: HC $1.00/MF $0.50 (Declassified)

Wind-tunnel studies at low speeds on four variable-wing-sweep airplane configurations indicated that the final arrangement, which was designed from information obtained on the first three, was longitudinally stable for all sweep angles above 12.5°, and directionally stable for all sweep angles and lift coefficients investigated with the maximum static margin only about 9.5% of the mean aerodynamic chord c; thereby the need for wing translation was eliminated. Pitch control provided by the horizontal tail was large, and was essentially invariant with either sweep angle or lift coefficient. The results of roll control effectiveness tests indicated that control provided by differential deflections of the horizontal tail looked more attractive than control provided by wing-tip ailerons although the favorable yawing moments due to roll control (by tails) might be excessive. Author

N65-24204# Massachusetts Inst. of Tech., Cambridge.
HYPERSONIC FLOW FIELD ABOUT A BLUNT SLAB WING AT ANGLE OF ATTACK, PHASE I
Robert J. Polutchko Wright-Patterson AFB, Ohio, ARL, Dec. 1964 111 p refs
(Contract AF 33(616)-7818)
(ARL-64-213; AD-615008).

Flow fields about blunt nosed wings and bodies at angle-of-attack are described. An investigation is made of the inviscid two-dimensional flow field about a blunt nosed flat plate and a larger transverse cylinder-plate at Mach 7.6 and angles-of-attack up to 40°. By traversing the flow between the wing and the bow shock at various chordwise stations with a pitot probe, the streamline patterns and the flow property variations along them are established for each angle-of-attack. Also included are schlieren photographs of the shock wave shapes, estimates of the boundary layer thicknesses, and results of a brief investigation to determine the feasibility of an experimental method of sonic line location. The inviscid three-dimensional flow field about a truncated 10° half-angle cone at Mach 7.6 and 4.07 and angles-of-attack up to 20° is described. Author

N65-24207# Bell Aerosystems Co., Buffalo, N. Y. Vehicle Structures Dept.
NONLINEAR THERMOELASTIC EFFECTS ON HYPERSONIC STABILITY AND CONTROL. PART III: SIMULATION, MEASUREMENT AND ANALYSIS OF NONLINEAR STATIC AEROTHERMOELASTIC BEHAVIOR OF A 45° DELTA
James R. Batt Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Feb. 1965 55 p refs
(Contract AF 33(657)-7486)
(FDL-TDR-64-16, Pt. III; AD-613708)

Results are presented of additional nonlinear structural–aerodynamic interaction experiments and analyses conducted on a 45° delta wing. The aeroelastic simulation scheme was used to experimentally determine the static aerothermoelastic behavior of the subject model wing. Test data were compared with theoretical predictions using the digital computer program. Author

N65-24266 Aeronautical Research Council (Gt. Brit.)
TRANSONIC TUNNEL TESTS ON A 6% THICK, WARPED 55° SWEPTBACK-WING MODEL
A. B. Haines and J. C. M. Jones London, HMSO, 1965 42 p refs Supersedes ARA-WTN-25, ARC-22466
(ARC-R&M-3385; ARA-WTN-25; ARC-22466) HMSO: 17s

Tests were made in a 9 × 8-ft transonic tunnel on a model having a 6% thick, 55° sweptback wing with a warp distribution designed to give a constant spanwise C_L-distribution and a triangular chordwise load at $C_L = 0.15$, $M = 1.2$. The wing–body junction was designed according to supersonic area rule for this Mach number. Subcritical-type flow is maintained over most of the wing under the design conditions. The margins in both Mach number at the design C_L and in C_L at the design Mach number before the start of any serious supercritical increase in drag or before the appearance of any significant shock-induced separations are of the order of 0.05. Major changes in the pitching-moment characteristics are even further delayed. At subsonic speeds and low C_L, K is near 1.2 while at the design conditions the approximate value from the experimental results is $K = 1.55$ as compared with a theoretical prediction of $K = 1.33$. The results suggest that it is unlikely that there was a sizable sweep factor on the wing skin-friction drag although no firm conclusion can be drawn about this. Translating the wing-fuselage drag results to a typical full-scale Reynolds number, L/D for $C_L = 0.15$ varied from about 12 at $M = 1.2/1.25$ to about 9 at $M = 1.4$. Some incremental drags are also given for a particular

fintail unit. Some data showing the downwash at the tail position both for this model and for a corresponding model having a symmetrical, untwisted wing are included. Author

N65-24267 Aeronautical Research Council (Gt. Brit.)
THE EFFECT OF FORWARD SPEED ON THE INLET FLOW DISTRIBUTION AND PERFORMANCE OF A LIFTING FAN INSTALLED IN A WING
N. Grégory, W. G. Raymer, and Edna M. Love London, HMSO, 1965 43 p refs Supersedes NPL-AERO-1018, ARC-23839; see X63-10697
(ARC-R&M-3388; NPL-AERO-1018; ARC-23839) HMSO: 16s 6d

Five-tube yawmeter traverses immediately up and downstream of the fan reveal the flow maldistributions due to forward speed. These are removed by a deep duct or an inlet cascade, which turn the air into the axial direction. Nonuniformity of the exit static pressure, however, does not affect the flow distribution. Since forward speed reduces the pressure rise required, stalling of the fan blades appears to be less dangerous except at very high forward speeds, or when a deflected exit cascade is fitted. Author

N65-24268 Aeronautical Research Council (Gt. Brit.)
THEORETICAL STABILITY DERIVATIVES FOR A SYMMETRICALLY TAPERED WING AT LOW SUPERSONIC SPEEDS
Doris E. Lehrian and Gillian Smart London, HMSO, 1965 16 p refs Supersedes NPL-AERO-1063, ARC-24710
(ARC-CP-736; NPL-AERO-1063; ARC-24710) HMSO: 3s 6d

A symmetrically tapered wing of aspect ratio 4 and taper ratio 5/11 with streamwise tips describes simple harmonic oscillations of low frequency in supersonic flow. Pitching and heaving derivatives are evaluated to first order in frequency, on the basis of linearized thin-wing theory, for Mach numbers in the range $1.017 \leq M < 2.50$. Comparisons are made with oscillatory strip theory and steady sonic theory. Author

N65-24270 Aeronautical Research Council (Gt. Brit.)
EFFECT OF LOW CURVATURE DUE TO THE FUSELAGE ON THE FLAPPING MOTION OF A HELICOPTER ROTOR
M. A. P. Willmer London, HMSO, 1965 32 p refs
(ARC-CP-782; RAE-TN-NAV-61; ARC-25524) Supersedes RAE-TN-NAV-61, ARC-25524 See X64-11337 HMSO: 6s

The effect of flow curvature due to the fuselage on the flapping motion of a helicopter rotor was investigated theoretically. This was achieved by calculating the changes in the flow through the disc and hence the additional aerodynamic moment about the flapping hinge, using a Rankine solid to represent the actual fuselage. It was found that in the tip speed range 0 to 0.6, only the higher harmonics are affected significantly and that the changes become more pronounced as the length of the fuselage is increased. Author

N65-24271 Aeronautical Research Council (Gt. Brit.)
WIND TUNNEL TESTS BETWEEN M = 0.4 AND 2.0 ON A CAMBERED WING OF SLENDER OGEE PLANFORM
M. D. Dobson and R. King-Underwood London, HMSO, 1965 33 p refs Supersedes RAE-TN-AERO-2933, ARC-25837
(ARC-CP-778; RAE-TN-AERO-2933; ARC-25837) HMSO: 6s

Results are presented of wind-tunnel tests made to examine the lift, longitudinal stability, and drag of a cambered wing with an ogee planform in the Mach range 0.40 to 2.00. Some flow visualization tests were also made, and photographs of the patterns obtained are included. Author

N65-24325 Aeronautical Research Council (Gt. Brit.)
MEASUREMENTS OF AERODYNAMIC DERIVATIVES ON A WING WITH A SERIES OF TIP BODIES
P. R. Guyett London, HMSO, 1964 49 p refs Supersedes RAE-STRUCT-285; ARC-24939
(ARC-R&M-3381; RAE-STRUCT-285; ARC-24939) HMSO: 1L

Oscillatory aerodynamic lift and pitching-moment derivatives were measured in a wind tunnel at low subsonic speeds on the following wing and wing-body combinations: (1) tapered wing of aspect ratio 1 to 3, midchord line unswept, with a sharp leading edge, (2) above wing fitted with a nacelle in three chordwise positions at the tip, and (3) wing at (1) fitted with a tip body representing a tank or store, and tested with and without a fin at the rear of the body. Measured derivatives for the wing alone agree with values calculated using lifting-surface theory, with values calculated using a semi-empirical method. Derivatives for the wing with nacelle in the central position were calculated using a semiempirical method which makes an allowance for aerodynamic interference effects; comparison shows that the values are reasonably accurate. Author

N65-24337# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics
CHARACTERISTICS OF A FAMILY OF DOUBLE-DELTA WINGS DESIGNED TO REDUCE AERODYNAMIC CENTER SHIFT WITH MACH NUMBER
Robert A. Tumilowicz (M.S. Thesis) Jun. 1965 66 p refs

Lift curve slopes and aerodynamic center locations of a family of double-delta wings were estimated. Wing planforms considered are characterized by low aspect ratio, relatively large area inner panels and higher aspect ratio, and smaller area outboard panels; they are designed for minimum aerodynamic center shift between subsonic and supersonic Mach numbers. The methods used to calculate the lift and aerodynamic center of these wings are based upon slender-body interference techniques for the subsonic case and the interference techniques of Beskin and Neilsen for the supersonic case. Good engineering approximations were possible through these techniques, without having to resort to the more difficult lifting surface theories. Author

N65-24372*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
NEWTONIAN AERODYNAMICS FOR BLUNTED RAKED-OFF CIRCULAR CONES AND RAKED-OFF ELLIPTICAL CONES
Edward E. Mayo, Robert H. Lamb, and Paul O. Romere Washington, NASA, May 1965 243 p refs
(NASA-TN-D-2624) CFSTI: HC $6.00/MF $1.50

Aerodynamic coefficients and stability characteristics of a proposed vehicular concept suitable for earth entry at hyperbolic speeds are discussed. The configurations considered were blunted raked-off circular cones and raked-off elliptical cones, and are envisioned trimming at zero angle of attack. The elliptical-cone configurations were confined to those which were raked off to produce a circular base. An afterbody will be added to the configurations to form a complete entry vehicle; therefore, the aerodynamics presented do not include the effects of the base. A comparison of the two configurations revealed that the raked-off circular-cone configuration has a slightly higher lift-to-drag ratio than the elliptical-cone configuration at the same rake-off angle. Author

N65-24373*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF TWO TRAILBLAZER II BLUNTED 9° CONE REENTRY BODIES AT MACH 6.8 IN AIR AND 21.2 IN HELIUM

Herbert R. Schippell, Luther Neal, Jr., and Don C. Marcum, Jr. Washington, NASA, May 1965 36 p refs
(NASA-TN-D-2786) CFSTI: HC $2.00/MF $0.50

The normal-force, axial-force, and pitching-moment coefficients of scale models of two 9°-blunted-cone reentry bodies with their afterbodies were measured in wind-tunnel tests. The bluntest of these is a scale model of the reentry body used on Trailblazer IIa. The other is a similar model of a proposed Trailblazer II reentry body with decreased nose bluntness. Tests were conducted in air at angles of attack from 0° to 180° at Mach 6.8 and a Reynolds number per foot of 1.68×10^6. Tests were also conducted in helium at angles-of-attack from 0° to 56°, at Mach 21.2, and a Reynolds number per foot of 8.64×10^6. The experimentally measured coefficients are compared with values predicted by a modified Newtonian theory and result in generally good agreement throughout the angle-of-attack range. The angle of attack at which afterbody effects begin to become measurable corresponds to that predicted by Newtonian theory. A six-degree-of-freedom motion study to estimate the reentry-body motions indicates that the angle of attack converges and does not exceed the physical boundary angle (19.8°) of the bodies with nozzle and antenna afterbody components. Author

N65-24383*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL AERODYNAMIC CHARACTERISTICS OF 10 SHORT AXISYMMETRIC BODIES AT MACH NUMBERS OF 5 TO 15
Gary T. Chapman, James E. Terry, and Scott Bruin Washington, NASA, May 1965 34 p refs
(NASA-TN-D-2848) CFSTI: HC $2.00/MF $0.50

The aerodynamic characteristics of three families of short axisymmetric bodies, 10 nose shapes in all, followed by a nominal one-diameter-long cylindrical afterbody are studied. The three geometric families were sharp cones, blunted cones, and ellipsoids. Variations within each family yielded four wave drag coefficients. Experimental values of drag coefficient, lift-curve slope, dynamic-stability parameter, and center of pressure are presented and compared with results from two simple theories. The short cylindrical afterbody contributed significantly to the lift, and also produced a rearward movement of the center of pressure; this was particularly evident with the sharp-nosed-cone configurations. In general, modified Newtonian theory underpredicts the drag by 5 to 30 percent; furthermore, it predicts little or no contribution to lift from the afterbody at small angles of attack. A simple hybrid theory which allowed for a contribution to lift from the afterbody showed much improvement on many of the configurations but greatly overpredicted the lift on the configurations with ellipsoidal noses. It is felt that a better estimate of the zero angle-of-attack pressure distributions would improve estimates made with the simple hybrid theory. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N65-23477*# National Aeronautics and Space Administration, Washington, D. C.
NASA SCIENTISTS REPORT ON AIRCRAFT IMPROVEMENTS, SAFETY
13 May 1965 43 p
(NASA News Release-65-160) Available from the Scientific and Technical Information Division

The National Aeronautics and Space Administration presents a synopsis on research accomplishments leading to significant improvements in the usefulness and safety of all types of aircraft. Covered are 34 papers that were presented at a 3-day conference on aircraft operating problems encompassing the design, development, and useful employment of aircraft of all kinds. G.G.

N65-23688*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESULTS OF USAF-NASA-FAA FLIGHT PROGRAM TO STUDY COMMUNITY RESPONSES TO SONIC BOOMS IN THE GREATER ST. LOUIS AREA
Charles W. Nixon and Harvey H. Hubbard (Aerospace Med. Res. Labs., Wright-Patterson AFB, Ohio) Washington, NASA, May 1965 30 p refs
(NASA-TN-D-2705) CFSTI: HC $2.00/MF $0.50

Data are presented from a series of community-reaction flight experiments in which the population of a large city was repeatedly exposed to sonic booms in the range of overpressures up to about 3.1 lb/sq ft. Results were obtained from direct interviews, analyses of complaint files, and engineering evaluations of alleged damage and are correlated with information on aircraft operations and sonic-boom pressure measurements. Personal-interview studies indicated that about 90% of those contacted experienced some interferences as a result of sonic booms, about 35% were annoyed by them, less than 10% had contemplated complaint action, and less than 1% had actually filed a formal complaint. The total number of complaints and subsequent claims were approximately proportional to the number of flights. Building responses are a significant factor in community response. Alleged building damage was superficial in nature and consisted mostly of cracks in brittle surfaces. Contributing factors other than sonic booms were noted in most of the damage cases. There were no reports of direct adverse physiological effects. Author

N65-23720# Hughes Tool Co., Culver City, Calif. Aircraft Div.
ENGINE AND WHIRL TESTS, XV-9A HOT CYCLE RESEARCH AIRCRAFT Summary Report
Carl W. Pieper Fort Eustis, Va., Army Transportation Res. Command, Feb. 1965 205 p refs
(Contract DA-44-177-AMC-877(T))
(HTC-AD-64-23(385-T-15); TRECOM-TR-64-67; AD-613339)

A summary of engine and whirl testing of the rotor and power module portion of the XV-9A is presented. The results of engine testing include operation of two gas generators into a common exhaust duct with transient power conditions. Rotor whirl test results of the hot cycle rotor used on the XV-9A are reported and include functional checkout, performance evaluation, and structural evaluation. Results of testing of a jet-reaction yaw control valve are included. Author

N65-23750# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEWS OF SCHOOLS OF HIGHER EDUCATION. AERONAUTICAL ENGINEERING Selected Articles

13 Jun. 1963 24 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), no. 2, 1962 p 15–22, 39–47
(FTD-TT-63-197/1+2; AD-411183)

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N65-23751 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF GYROSCOPIC MOMENTS FROM THE POWER INSTALLATION ON THE DYNAMICS OF THE AIRCRAFT

V. I. Klimov *In its* News of Schools of Higher Educ. Aeron. Eng. 13 Jun. 1963 p 1–10 refs (See N65-23750 13-02)

The dynamics equations of motion of an absolutely rigid aircraft, in a bound system of coordinates directed along the main axes of inertia and originating in the cg of the aircraft, were used to establish the different factors that constitute the bond of longitudinal and lateral movements in an effort to evaluate the effects of gyroscopic moments on the dynamics of aircraft. It was found that gyroscopic moments from power installations can affect the dynamics of certain aircraft considerably by making piloting difficult and reducing the density of the movement when flying in turbulent weather. A greater effect of aerodynamic and structural parameters as well as flight conditions on the nature of intersecting bonds of longitudinal and lateral movements is also evident. The use of special automatic devices for aerodynamic compensation of gyroscopic moments is recommended in some cases. G.G.

N65-23752 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LIMITATION OF OSCILLATIONS IN A LINEAR SYSTEM OF STABILIZING A STABLE LONGITUDINAL MOVEMENT

M. Z. Litvin-Sedoy *In its* News of Schools of Higher Educ. Aeron. Eng. 13 Jun. 1963 p 11–21 refs (See N65-23750 13-02)

A method based on known evaluations of the maximum value for the solution of a stable linear homogeneous differential equation with constant coefficients at given initial conditions was used to synthesize laws of control in linear systems with constant centered parameters. This method assures a preset limitation of the controlled coordinates if the perturbed motion was caused by definite instantaneous initial deviations of system variables. Examined was a system with an ideal autopilot developed from equations of the real autopilot with consideration of inertia of amplifiers and transformers. The application of the general theory of linear equations with small coefficients at higher derivatives established that the boundary of the zone of control parameters in a general case will change only slightly. G.G.

N65-23923*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

RESUME OF HANDLING QUALITIES OF THE X-15 AIRPLANE

Robert M. White (AF Flight Test Center), Glenn H. Robinson, and Gene J. Matranga Washington, NASA, Mar. 1962 19 p refs
(NASA-TM-X-715) CFSTI: HC $1.00/MF $0.50 (Declassified)

A summary of handling qualities is presented as assessed from pilot opinion and flight data. Segments of the flight profile evaluated include the launch, climbout, semiballistic flight, atmosphere entry, and landing. Longitudinal controllability is compared with results from current studies of reentry-type vehicles. Author

N65-23924*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

LATERAL-DIRECTIONAL CONTROL OF THE X-15 AIRPLANE

Forrest S. Petersen, Herman A. Rediess, and Joseph Weil Washington, NASA, Mar. 1962 26 p refs
(NASA-TM-X-726) CFSTI: HC $2.00/MF $0.50 (Declassified)

The deterioration of lateral-directional controllability with roll damper off and the pilot performing a lateral-control task is discussed. The problem area was defined by fixed-base and airborne simulators and verified by closed-loop analysis in which a human transfer function represents the pilot. A parameter which predicts the problem area for the X-15 airplane is developed. The means considered to alleviate the control problem in the X-15 airplane are also discussed. Author

N65-24033# Royal Aircraft Establishment, Farnborough (England).

THE LONGITUDINAL RESPONSE OF A FLEXIBLE SLENDER AIRCRAFT TO RANDOM TURBULENCE

E. Huntley London, Min. of Aviation, Aug. 1964 71 p refs
(RAE-AERO-2691)

The responses of a slender supersonic transport aircraft flying through random turbulence were evaluated for the cruise condition. The problem was simplified by assuming that the aircraft responds only in heave, pitch, and longitudinal bending as defined by the fundamental normal mode and by using piston theory aerodynamics. The results show that the CG normal acceleration response is very dependent on the pitching degree of freedom but is relatively little affected by flexibility. Flexibility does have an important effect on normal acceleration at the aircraft nose, where it increases the rms value by a factor of 2.2, but has negligible effect over the rear 70% of the aircraft length. It is shown that strains occurring in the fundamental mode can be correlated with CG accelerations, the factor relating them being 1.37 times the strain per g that would be measured in a steady pullout. Author

N65-24101*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CONFERENCE ON THE PROGRESS OF THE X-15 PROJECT Research-Airplane-Committee Report

[1965] 277 p refs Compilation of the papers presented at the Langley Aeron. Lab., Langley Field, Va., 25–26 Oct. 1956
CFSTI: HC $6.00/MF $1.50 (Declassified)

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19. SUMMARY OF PERTINENT PROBLEMS AND CURRENT STATUS OF THE X-15 AIRPLANE Lawrence P. Greene (North Am. Aviation, Inc.) p 239–258

N65-24220# Litton Systems, Inc., St. Paul, Minn. Applied Science Div.

DETERMINATION OF THE SHAPE OF A FREE BALLOON Scientific Report No. 4

Justin H. Smalley Bedford, Mass., AFCRL, 1 Nov. 1964 46 p refs *Its* Rept.-2671

(Contract AF 19(628)-2783)

(AFCRL-65-68; AD-613203)

Modifications of the basic balloon-shape equations are developed for cylinder and cylinder-end balloons, taper-tangent balloons, and tangent-harness balloons. Examples of the shapes of these balloons are presented, and corresponding meridional stresses are determined. Zero and nonzero circumferential stresses are considered. Author

N65-24246# Aviation Safety Engineering and Research, Phoenix, Ariz.

CRASHWORTHINESS EVALUATION OF AN ENERGY-ABSORPTION EXPERIMENTAL TROOP SEAT CONCEPT

Langston W. T. Weinberg Ft. Eustis, Va., Army Transportation Res. Command, Feb. 1965 81 p

(Contract DA-44-177-AMC-116(T))

(AvSER-64-11; TRECOM-TR-65-6; AD-614582)

The basic concept was a single-passenger, side-facing, bucket seat. Anthropomorphic dummies, restrained by lap belts and single diagonal chest straps, provided simulated human loading characteristics during impact. Accelerometers mounted in the pelvic cavity of the dummies permitted recording of impact decelerations. Floor accelerations were measured near the seat installations. Tensiometers recorded the belt forces. High-speed cameras recorded the reaction of the dummies and experimental seats during the crash sequences. Seats were divided into two basic functional units: a seat base incorporating an energy-absorbing strut to provide the vertical support; and a curved nylon seat back designed to provide restraint in the lateral and longitudinal directions. The test series demonstrated the effectiveness of strut-type energy absorption as a method of attenuating crash forces. Author

N65-24334# Royal Aircraft Establishment, Farnborough (England).

THE EFFECT OF AN AUTOPILOT ON THE DYNAMICS AND FLIGHT SAFETY OF A NON-RIGID AIRCRAFT IN A TURBULENT ATMOSPHERE [VLIYANIE AVTOPILOTA NA DINAMIKU I BEZOPASNOST' POLETA NEZHESTKOGO SAMOLETA V TURBULENTNOI ATMOSFERE]

Yu. P. Dobrolenskii London, Min. of Aviation, Jan. 1965 28 p refs Transl. into ENGLISH from Tekh. Kibernetika (USSR), no. 3, 1964 p 154–169

(RAE-LIB-TRANS-1096)

The dynamics of an aircraft having a flexible wing was examined in flight in a turbulent atmosphere. It was shown that consideration of the deflection of the wing dependent upon its design can lead both to a reduction and to an increase of the stresses experienced by the aircraft. The effect of an autopilot on the statistical characteristics of longitudinal motion and on flight safety in a field of vertical gusts was demonstrated. Author

N65-24339# Army Transportation Research Command, Fort Eustis, Va.

UH-2A JET AUGMENTED RESEARCH HELICOPTER MANEUVERABILITY AND DYNAMIC STABILITY EVALUATION Preliminary Flight Test Data, Interim Report

Michael J. Strok Jan. 1965 42 p refs

(IR-10)

This report presents results of research on the effect of horizontal thrust augmentation from an auxiliary jet engine on the maneuverability and dynamic stability of the UH-2 helicopter. Effect of transient and steady-state load factors on the airspeed envelope, as limited by retreating blade stall, was examined for three values of thrust augmentation. The onset of blade stall is shown to be delayed to higher airspeed by application of thrust augmentation; the extent of the delay increases with load factor. For a given amount of thrust augmentation, the load factor in transient maneuvers is shown to be higher than for steady accelerated flight conditions. Dynamic response of the helicopter in pitch and yaw to simulated gust inputs was examined for various combinations of thrust augmentation and airspeed. Thrust augmentation tends to decrease control sensitivity and to provide increased damping about both pitch and yaw axes following a disturbance. Author

N65-24340# Army Transportation Research Command, Fort Eustis, Va.

UH-1B HIGH PERFORMANCE HELICOPTER Preliminary Flight Test Data, Interim Report

Nov. 1964 32 p

(IR-5)

Trailing-edge flaps were installed on the inboard section of a UH-1B rotor and tested on the high-performance helicopter to determine a flap position which would offset the rotor blade noseup pitching moments in the area of $\Psi = 270°$ and result in a reduction of the rotor control loads. Magnitudes of the control load and inboard flap section bending moment

at $\Psi = 270°$ were found dependent on advance ratio and independent of flap position, and were approximately the same for all flap positions tested. The flap bending moments in the inboard section at $\Psi = 270°$ and the outboard section at $\Psi = 90°$ and 270° vary directly with the flap position. Primary cause of the high positive control load component at $\Psi = 270°$ is probably a result of a download (noseup pitching moment) on the rotor blade in the reverse flow region. It is concluded that inboard blade cutouts and/or special blade cuffs can provide a significant reduction in the rotor control loads. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N65-23702# General Motors Corp., Indianapolis, Ind. Applied Sciences Dept.

RADIANT ENERGY CONVERSION

A. H. Smith and R. C. Bourke *In its* Allison Res. and Eng., Vol. No. 5, 1st Quarter 1965 [1965] p 16–22 (See N65-23700 13-32)

A radiant energy conversion system is described which consists essentially of a source of infrared radiation and a photovoltaic cell array. Further, the photovoltaic cell, semiconductors, the p-n junction, source considerations, photon regeneration, and the laboratory model are discussed. Although no real emitter satisfies black-body conditions, silicon carbide closely approximates it with an emissivity of 0.8 for all wavelengths. The radiation from a SiC surface is shown at 1800° K for a total of 46 W/sq cm. An array of photocells surrounding a SiC source would respond with a cell conversion efficiency of about 5% if the source to cell distance were such that the incident flux density were 2 W/sq cm. If the source could be designed to emit more of its energy below 1.8 microns, the cell conversion efficiency would be higher. Interference filters developed with reflection properties act as photon sorters, reflecting back to the hot source for absorption photons which cannot be used in pair production in the photovoltaic cells. This is in effect a regenerating system in which otherwise wasted energy is returned to the source. E.E.B.

N65-23703*# Globe-Union, Inc., Milwaukee, Wis.

A PROGRAM TO DEVELOP A HIGH-ENERGY DENSITY PRIMARY BATTERY WITH A MINIMUM OF 200 WATT HOURS PER POUND OF TOTAL BATTERY WEIGHT Third Quarterly Report, Jan.–Mar. 1965

William E. Elliott, James R. Huff, Robert W. Adler, and Warren L. Towle Washington, NASA, 19 Apr. 1965 133 p
(Contract NAS3-6015)
(NASA-CR-54375) CFSTI: HC $4.00/MF $1.00

Over one hundred nonaqueous electrolytes with conductivities in excess of 1×10^{-2} ohm^{-1} cm^{-1} were developed. Quantitative determinations of conductance and viscosity as a function of electrolyte concentration resulted in an empirical equation enabling prediction of conductance at a given concentration within an order of magnitude, provided that the viscosity of the solution and the dielectric constant of the solvent are known. Eighty-seven anode–electrolyte combinations were studied electrochemically in a screening program designed to single out systems most promising for further development. Four systems discovered could sustain discharges at 100 mA/cm^2 without excessive polarization. An additional 41 systems could sustain at least 10 mA/cm^2. Chemical stability tests involving anode materials were carried out in 95 of the more highly conductive electrolytes. Author

N65-23718*# Harshaw Chemical Co., Cleveland, Ohio. Crystal-Solid State Div.

RESEARCH AND DEVELOPMENT IN CdS PHOTOVOLTAIC FILM CELLS Third Quarterly Report, Nov. 19, 1964–Feb. 19, 1965

T. A. Griffin, D. J. Krus, and J. C. Schaefer [1965] 23 p
(Contract NAS3-4177)
(NASA-CR-54346) CFSTI: HC $1.00/MF $0.50

Development of the CdS solar cell continued toward the goals of improved cell life under thermal cycling tests, improved collection efficiency, and improved cell fabrication techniques. Efforts to improve properties of the electroplated collector grid of the CdS thin film solar cell by procedural changes continued. The large power losses of 50% to 75% initially encountered were reduced to less than 10%. Nonuniformities in the barrier layer were found and photographed. Minor success was achieved in forming a sintered CdS layer displaying a photovoltaic effect. A new laminator was installed providing even heat distribution and a large saving in time and convenience. Author

N65-23791* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN EMERGENCY HELIUM BUBBLING CONTROL SYSTEM FOR THE PREVENTION OF GEYSERING IN THE LOX SUCTION LINES OF S-IC

James A Power and A. Turel (Brown Eng. Co.) *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 78–86 (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

An emergency helium bubbling system was devised for geyser suppression in the LOX suction lines of S-IC. Flight model pressure and temperature transducers were compared to more accurate transducers to determine the best sensor configuration. Transducers were electronically simulated to calibrate the circuit design. A development system was tested for feasibility on a full-scale LOX flow line test facility. Author

N65-23797*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.

TWO STAGE POTASSIUM TEST TURBINE Quarterly Progress Report No. 14, Aug. 8–Nov. 8, 1964

E. Schnetzer, ed. [1964] 308 p
(Contract NAS5-1143)
(NASA-CR-54285) CFSTI: HC $7.00/MF $1.75

A two-stage potassium vapor turbine is being developed. This turbine was tested with potassium vapor for approximately 45 hours. The test conditions were 1430° to 1570° F inlet temperature, turbine pressure ratios from 1.9 to 4.2, vapor flow rates from 1.4 to 2.6 lbs/sec and power output up to 165 KW. Author

N65-23831*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GENERATION OF ALTERNATING CURRENT BY A POWER DIODE

Arthur W. Goldstein, Willis H. Braun, and James R. Rose Washington, NASA, May 1965 19 p refs
(NASA-TM-X-1099) CFSTI: HC $1.00/MF $0.50

In the device analyzed, electron current in the diode is controlled by a magnetic field, which constitutes the means of providing for regenerative feedback in an oscillator circuit. With the use of experimentally determined characteristics of a magnetically controlled diode, the differential equations governing the circuit are solved numerically for several selected diode–circuit combinations. It was shown from these calculations that an oscillating current output can be obtained and that the current was fully modulated from nearly zero to nearly the maximum obtainable in steady-state operation. The greatest calculated power output was 36% of that obtainable from constant current operation and consisted of 58% dc and 42% ac power. The frequency of oscillation was nearly equal to that calculated from linear circuit theory, which also yielded a criterion for the onset of oscillations. Author

N65-23844*# Harshaw Chemical Co., Cleveland, Ohio. Crystal-Solid State Div.
DEVELOPMENT OF OPTICAL COATINGS FOR CDS THIN FILM SOLAR CELLS First Quarterly Report, Dec. 2, 1964–Mar. 1, 1965
J. C. Schaefer and E. R. Hill [1965] 20 p
(Contract NAS3-6464)
(NASA-CR-54336) CFSTI: HC $1.00/MF $0.50

Coatings of SiO and MgF were deposited by thermal vacuum evaporation. Films over 1μ thick were mechanically unstable and thus were not suitable for use on the solar cell. A sputtering unit was assembled to deposit glass coatings. This unit uses a triode-plasma technique with rf oscillatory potential applied to the target to allow sputtering of dielectrics. Measurements of reflectance of materials of known reflectance on surfaces similar to that of the solar cell were made. This is to evaluate the effect of Rayleigh scattering from the cell surface so that the reflectance data on the cell can be interpreted. Author

N65-23929*# Electro-Optical Systems, Inc., Pasadena, Calif.
EVALUATION OF REGENERATIVE FUEL CELL Final Report, 21 Sep. 1960–9 Mar. 1962
Harvey A. Frank 9 Apr. 1962 54 p refs
(Contract NAS7-7)
(NASA-CR-62757; EOS-1584-Final) CFSTI: HC $3.00/MF $0.50

Evaluation of regenerative hydrogen–oxygen fuel cells, that stored oxygen throughout the porous asbestos bed and hydrogen in the nickel electrode, indicated a loss of charge in 2 hours. A modified cell configuration where hydrogen and oxygen are stored in miniature gas cylinders and where the nickel electrode is coated with platinum black established a reduced self-discharge rate and the delivery of reasonable currents at room temperature. A nine-cell unit with platinized nickel electrodes for both H_2 and O_2 was tested, and delivered up to 25 watts. Primary evaluation of a silver–hydrogen cell where the hydrogen is stored in a cylinder and a silver–silver oxide electrode is used appears to offer a potentially high power efficiency but seems to indicate charge retention. G.G.

N65-23952# European Space Vehicle Launcher Development Organization, Paris (France).
SILICON SOLAR CELLS FOR POWERING SPACE VEHICLES
M. M. Gilli Oct. 1964 24 p refs
(ELDO-TM-F-7)

In considering how solar cells can be most efficiently mounted on space vehicles, it is shown that the most important factor is the specific weight of the power source, taking into consideration the space environment and the particular missions requiring intermittent supplementary power consumption. Author

N65-24017*# Northrop Space Labs., Huntsville, Ala. Space Systems Section
APOLLO LOGISTICS SUPPORT SYSTEMS MOLAB STUDIES. POWER SYSTEM ANALOG SIMULATION FOR A MOBILE LABORATORY
C. O. DeLong Huntsville, Ala., NASA. Marshall Space Flight Center, Mar. 1965 61 p refs
(Contract NAS8-11096)
(NASA-CR-61052) CFSTI: HC $3.00/MF $0.75

A simulation study analysis is performed on the electric power system for the Lunar Mobile laboratory. Each subsystem and component is analyzed and related to the integrated system. Characterization of subsystem and components is performed utilizing simple electrical analogs to describe flows of heat, fluids, and gases as related to system observables and device parameters. The problems of logical control and decision in the area of the power distribution system are further defined and examined as related to automatic operation. Author

N65-24025*# Unified Science Associates, Inc., Pasadena, Calif.
GASEOUS ELECTROLYTES FOR BATTERIES AND FUEL CELLS Second Quarterly Report, 21 Nov. 1964–20 Feb. 1965
S. Naiditch [1965] 36
(Contract NAS7-326)
(NASA-CR-62791) CFSTI: HC $2.00/MF $0.50

The objective is to evaluate the applicability of dense gaseous electrolytic solutions to energy conversion. Ammonia is used as the gaseous solvent. The experimental studies are carried out in hermetically sealed glass vessels. Since the gaseous solvents are at pressures of the order of 112 atmospheres, external pressure is used to prevent rupture of the glass. Main features of cell design are summarized. Reproducible emf data at low temperatures and preliminary emf and conductivity data to about 100°C are given. In extending the data above this temperature, the difficulty is that as the critical region is approached, the solutions become turbulent and the half cells develop open circuit characteristics. Author

N65-24232# Joint Publications Research Service, Washington, D. C.
SOLAR PHOTOELECTRIC BATTERIES
G. V. Lashkarev, A. M. Taranets, and V. S. Fomenko 19 May 1965 17 p refs Transl. into ENGLISH of chapter 5 from the book "Novyye Istochnik Elektricheskoy Energii" Kiev, Izd. Akad. Nauk Ukr. SSR, 1962 p 71–86
(JPRS-30167; TT-65-31038) CFSTI: $1.00

A method for fabricating photocells by diffusing phosphorus on p-type silicon for use in the conversion of solar energy into electricity, is discussed. A solar battery for supplying power to a radio receiver and a miniature fan, and a battery for a cosmic particle counter, are exemplified. The use of solar batteries on artificial satellites, as the source of electrical energy for interplanetary spaceships, and the utilization of solar energy for supplying the electrical power of the Soviet Union, is discussed. A discussion of the technological development of photocells is also included. S.C.W.

N65-24256# Union Carbide Corp., Cleveland, Ohio. Electrochemical Product Development Lab.
ALKALINE-MnO_2 BATTERY Quarterly Report, 1 Nov. 1963–31 Jan. 1964
P. B. Doll and R. D. Harmon 28 Jan. 1965 55 p
(Contract DA-36-039-SC-89098)
(QR-7; AD-462026)

Work accomplished was in two phases: (1) The data and statistical work reported in the sixth quarter were completed, with no change in the overall conclusions affecting the work.

Within-lot variances have been calculated. (2) Increased cathode density, a critical factor in battery performance at −40° F, is obtained by densification of the cathode preform which will be utilized in the planned factory trial. Author

N65-24338*# Aeronutronic, Newport Beach, Calif.
DEVELOPMENT OF A HIGH TEMPERATURE BATTERY
W. J. Subcasky, T. M. Place, H. A. Parker-Jones, and W. G. Anderson 20 Apr. 1965 50 p refs
(Contract NAS3-6002)
(NASA-CR-54404; U-4000) CFSTI: HC $2.00/MF $0.50

Experimental cells with sodium anodes and CuCl cathodes were discharged. Membranes used to separate anode and cathode compartments were fabricated from a NaX zeolite or a high sodium porcelain. Cell lives varied from 6 to 22 hours. Tests indicated attack of the membrane by molten alkali metals, which substitution of a magnesium or magnesium alloy anode with a LiCl–KCl anolyte for the sodium eliminated. Cell life was still erratic but in two cases cell lives approaching 70 hours under drain were achieved. Cracking of the zeolite membranes was ascribed to a volume change which occurred when the sodium ions in the zeolite were replaced with lithium ions from the anolyte. Cells constructed with other porous separators and molten CuCl cathodes had lives of the order of 15 hours compared to cells with porous separators and solid CuO cathodes which had lives in excess of 72 hours. Author

N65-24374*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STUDY OF LUNAR LANDING SITES AND ASSOCIATED STAY TIMES
Laurence W. Enderson, Jr. Washington, NASA, May 1965 38 p refs
(NASA-TN-D-2795) CFSTI: HC $2.00/MF $0.50

A study utilizing the results of a patched conic approximation was conducted to determine the possible landing sites and associated stay times on the lunar surface that are compatible with the lunar-orbit-rendezvous technique, that is, descent from and return to a vehicle orbiting the moon. Particular emphasis is placed on landing sites that allow a return to the established lunar orbit at all times during the exploration period. Three different landing and takeoff maneuvers are considered as well as the effect of variations of the energy and inclination of the earth-to-moon transfer trajectory. Consideration is given to maneuvers that permit the most flexibility in selection of landing sites as well as maneuvers that allow the longest stay time on the lunar surface for a given total plane-change capability. The results of this study indicate that the landing sites and associated stay times are strongly dependent on the inclination of the established lunar orbit as well as the specific landing and takeoff maneuvers that are employed. Author

N65-24380*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS AND EVALUATION OF A VAPOR-CHAMBER FIN-TUBE RADIATOR FOR HIGH-POWER RANKINE CYCLES
Henry C. Haller, Seymour Lieblein, and Bruce G. Lindow Washington, NASA, May 1965 63 p refs
(NASA-TN-D-2836) CFSTI: HC $3.00/MF $0.75

An analytical investigation of a flat, direct-condensing fin-tube radiator employing segmented vapor-chamber fins as a means of improving heat rejection was performed for illustrative high-power, high-temperature Rankine space power electric generating systems. The analysis of the vapor-chamber fin-tube radiator considered pressure drop in the radiator tubes and headers, meteoroid protection for the tubes, headers, and vapor-chamber fins, and temperature drop in the tube armor in the development of the descriptive equations. The heat transfer, weight, and geometric characteristics of the vapor-chamber fin-tube radiator were determined over a wide range of variables for two illustrative radiator design applications. The vapor-chamber fin-tube radiator was also compared to the more conventional solid-conducting double fin-tube and central fin-tube radiators on a weight and geometry basis for a nonredundant configuration with a high level of nonpenetration probability. The radiator can function as a solid-conducting configuration after the vapor chambers have been punctured by meteoroids; hence, its thermal effectiveness does not decrease in direct proportion to the number of fin segments punctured. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; protective clothing and equipment; physiological and psychological factors. For related information see also: 05 Biotechnology.

N65-23364 Joint Publications Research Service, Washington, D. C.
ON THE DYNAMIC ANALYSIS AND MODELING OF SOME SENSITIVE ELEMENTS
Fan-chi Ku, Chuan-chuan Ch'en, and Hsiang-sheng Wang *In its* Transl. on Communist China's Sci. and Technol. 29 Apr. 1965 p 6–15 refs (See N65-23363 13-34) CFSTI: $3.00

Research on the dynamic characteristics of sensitive elements is reported. The following characteristics of sensitive elements following a stimulus were considered: (1) There is an incubation period. (2) The dynamic characteristics after the incubation period could be represented by the transfer function $K(S) = K_1 + K_2S/1 + T_0S$. Using this equation, a model was derived to approximate the experimental curves of the sensitive elements of the knee of a cat, the single fiber sensitivity to cold on the tongue tip of a cat, the touch sensitivity of frogs and toads, and the toad III short muscle fiber for extending the toe. Models were further used to develop the speed following stimulation and the variation of strength, which were compared with the theoretical curves. When these results were compared with experimental values, models were obtained and the following relations determined: (1) the relation between the greatest impulse frequency and the speed of stimulus, (2) the relation between the transition time and the variation of the stimulus, and (3) the relation between the stable value of stimulus strength and the stable value of impulse frequency. The feasibility of this model is exemplified. Inherent problems of the model are discussed. S.C.W.

N65-23371# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 172
19 Apr. 1965 70 p Transl. into ENGLISH from K'o Hsueh T'ung Pao (Peking), no. 2, 1965
(JPRS-29641; TT-65-30762) CFSTI: $3.00

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3. THE EFFECT OF X-RAY ON THE FORMATION OF ORGANIC PEROXIDES IN THE BODY AND THE RELATIONSHIP BETWEEN ORGANIC PEROXIDES AND MERCAPTO COMPOUNDS I-sheng Chang, Shang-chun Mei, Lin-li Chou, Wen-yun Liu, Shu-p'ing Miao, and Jui-ch'uan Hung p 44–52 refs (See N65-23374 13-04)

4. CHANGE OF STATIC POTENTIAL IN THE EGG CELL DURING OVULATION OF BUFO BUFO GARGARIZONS Chang Ch'ung-li, Yu Mu-chen, and Chang Chih-i p 53–57 ref

5. SECOND NATIONAL QUATERNARY PERIOD SYMPOSIUM Liu Tung-sheng and Cheng Hung-han p 58–60

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7. SZECHWAN PROVINCIAL ACADEMY OF AGRICULTURAL SCIENCES STUDIES FIRST LINE AGRICULTURAL PRODUCTION Kuo Li-hsiao and Yeh Chi p 64–67

N65-23373 Joint Publications Research Service, Washington, D. C.

THE ELECTRICAL ACTIVITIES, ESPECIALLY THE INHIBITORY ACTION OF THE CALYX-LIKE SYNAPSES, OF A NEURON IN THE TRAPEZOID BODY

Hsiang-t'ung Chang *In its* Transl. on Communist China's Sci. and Tech. 19 Apr. 1965 p 23–43 refs (See N65-23371 13-34) CFSTI: $3.00

The electrical characteristics of the various types of neurons in the trapezoid nucleus were studied on anesthetized rabbits by recording electrodes inserted into the trapezoid nucleus along either side of the ventral, median, and lateral veins on the ventral side of the medulla. Emphasis was placed on observations of the inhibitory action of the calyx-like synapses in response to stimulating sound. The latency in response was used as criterion to distinguish between long-latency and short-latency neurons. The great majority of the neurons were found to be of the short-latency type with a latency of 3 to 4 milliseconds. Long-latency neutrons responded only to clicks applied contralaterally and showed increased latency with the increase of click intensity. Double stimuli with a 2- to 8-millisecond interval between the two successive stimuli showed that the response to the first click can be repressed by the second click, which seems to indicate an inhibitory phase of 2- to 8-millisecond duration. A single click can interrupt the spontaneous rhythmic activity in long-latency neutrons while an inhibitory postsynaptic potential appears at the same time. The long-latency neuron was identified as the neuron that receives the calyx-like synapses and its inhibitory action. G.G.

N65-23374 Joint Publications Research Service, Washington, D. C.

THE EFFECT OF X-RAY ON THE FORMATION OF ORGANIC PEROXIDES IN THE BODY AND THE RELATIONSHIP BETWEEN ORGANIC PEROXIDES AND MERCAPTO COMPOUNDS

I-sheng Chang, Shang-chun Mei, Lin-li Chou, Wen-yun Liu, Shu-p'ing Miao, and Jui-ch'uan Hung *In its* Transl. on Communist China's Sci. and Tech. 19 Apr. 1965 p 44–52 refs (See N65-23371 13-34) CFSTI: $3.00

The formation of peroxides together with the determination of water soluble mercapto compounds and choline esterase was studied in the brains, testicles, and livers of white male laboratory mice after exposure to 700 *r* X-ray for various lengths of time. It was found that the contents of peroxides in the organs of the animals changed only slightly; most samples showed a slight decrease before 24 hours or after the sixth day. The rise and fall curves of peroxides and mercapto compounds in the liver were quite similar and the contents of peroxides and mercapto compounds in the testicles were relatively low 8 hours after exposure to radiation. Exposure to 700 γ radiation for 2 hours to 5 days increased the activity of choline esterase in the brain and liver in relation to the control animals. A comparison of the peroxides and water soluble mercapto compounds content did not show any relationship. It was concluded that the rise in activity of choline esterase is probably caused by indirect physiological compensation. G.G.

N65-23422# Joint Publications Research Service, Washington, D. C.

CLINICAL AND PHYSIOLOGICAL ASPECTS OF INTERPLANETARY AND ORBITAL FLIGHTS

28 Apr. 1965 19 p refs Transl. into ENGLISH from Klin. Med. (USSR), v. 43, no. 2, Feb. 1965 p 3–12
(JPRS-29795; TT-65-30839) CFSTI: $1.00

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1. CLINICAL ASPECTS OF INTERPLANETARY FLIGHTS V. V. Parin, Ye. B. Zakrzhevskiy, and R. M. Bayevskiy p 1–6 (See N65-23423 13-04)

2. CLINICO-PHYSIOLOGICAL ASSESSMENT OF SEISMOCARDIOGRAPHIC DATA OBTAINED DURING THE ORBITAL FLIGHTS OF VOSTOK-5 AND VOSTOK-6 R. M. Bayevskiy and Yu. N. Volkov p 7–16 refs (See N65-23424 13-04)

N65-23423 Joint Publications Research Service, Washington, D. C.

CLINICAL ASPECTS OF INTERPLANETARY FLIGHTS

V. V. Parin, Ye. B. Zakrzhevskiy, and R. M. Bayevskiy *In its* Clin. and Physiol. Aspects of Interplanet. and Orbital Flights 28 Apr. 1965 p 1–6 (See N65-23422 13-04) CFSTI: $1.00

Clinical aspects include the determination of prophylactic measures, diagnostic procedures, and individual technical systems peculiar to interplanetary travel with a crew. The illnesses during interplanetary travel can be classified as those induced by living conditions, brought about by the action of interplanetary space factors, or connected with endogenous factors. A probability approach to the illnesses of interplanetary crews is of major importance in planning diagnostic procedures as well as medical aid. Clinical effectiveness has been demonstrated for the algorithms of automatic medical checkups which have been worked out for use in a spaceship. G.G.

N65-23424 Joint Publications Research Service, Washington, D. C.

CLINICO-PHYSIOLOGICAL ASSESSMENT OF SEISMOCARDIOGRAPHIC DATA OBTAINED DURING THE ORBITAL FLIGHTS OF VOSTOK-5 AND VOSTOK-6

R. M. Bayevskiy and Yu. N. Volkov *In its* Clin. and Physiol. Aspects of Interplanet. and Orbital Flights 28 Apr. 1965 p 7–16 refs (See N65-23422 13-04) CFSTI: $1.00

A clinicophysiological evaluation of the seismocardiographic data obtained during flights of the Vostok-5 and -6 is presented. The telemetric recordings of seimocardiograms were compared by juxtaposition on seismocardiograms of healthy persons and patients, and established a definite phasal nature for the reactions of the cardiovascular system to prolonged weightlessness. The phase of relatively stable adaptation comprises the following two periods: (1) concurrent action of extracardiac and intracardiac mechanisms of compensation; and (2) predominant action of intracardiac mechanisms. Since clinical data of patients with neurocirculatory dystonia

and hypertension of the I to II stage established the extracardiac mechanisms as the last resources of the human system in its adaptation to morbid conditions, it was concluded that prolongation of the compensation mechanisms under conditions of space travel appears to be an unfavorable condition. G.G.

N65-23443# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS FROM PATOLOGICHESKAYA FIZIOLOGIYA I EKSPERIMENTAL'NAYA TERAPIYA (PATHOLOGICAL PHYSIOLOGY AND EXPERIMENTAL THERAPY), VOLUME VIII, NO. 6, 1964
20 Apr. 1965 28 p refs Transl. into ENGLISH from Patol. Fiziol. i Eksperim. Terapiya (Moscow), v. 8, no. 6, Nov.–Dec. 1964 p 3–7, 32–35, 40–43, 73–74
(JPRS-29666; TT-65-30775) CFSTI: $2.00

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1. EFFECT OF G-FORCES ON THE HIGHER NERVOUS ACTIVITY OF DOGS P. V. Vasil'yev and M. G. Gerd p 1–8 refs (See N65-23444 13-04)

2. THE EFFECT OF IMMUNOTHERAPY ON THE STATE OF TISSUE CALCIFICATION IN RATS WITH THERMIC BURNS B. Ye. Movshev p 9–14 refs

3. VESSELS OF EXTREMITIES IN ACUTE DISTURBANCE OF THE CORONARY CIRCULATION A. V. Dokukin p 15–21 refs

4. THE EFFECT OF SOUNDS AND PHOTIC STIMULI LASTING FOR A LONG PERIOD OF TIME ON DEVELOPMENT OF AN EXPERIMENTAL ATHEROSCLEROSIS IN FEMALE RABBITS I. D. Nasledova and Ya. D. Rafal'skiy p 22–25 ref (See N65-23445 13-04)

N65-23444 Joint Publications Research Service, Washington, D. C.
EFFECT OF G-FORCES ON THE HIGHER NERVOUS ACTIVITY OF DOGS
P. V. Vasil'yev and M. G. Gerd *In its* Transl. from Patol. Fiziol. i Eksperim. Terapiya (Pathological Physiol. and Exptl. Therapy), Vol. VIII, No. 6, 1964 20 Apr. 1965 p 1–8 refs (See N65-23443 13-04) CFSTI: $2.00

The effects of transversely oriented accelerations, which possessed characteristics similar to actual space flight accelerations, on the higher nervous activity and general behavior of animals were investigated. The sensory motor reactions of dogs were studied to determine the effect of G-forces on conditioned reflex activity. A positive conditioned stimulus and differential stimuli were used, and G-forces were created on a centrifuge with a radius of 3.5 m. The magnitudes of the G-forces, their rise rates and the period of the effect were reproduced according to the schedule of orbital insertion of space ships. Results show that disturbances in the correlation of excitation and inhibition processes occurred in the cerebral cortex as a result of transverse G-forces. In most animals, this was manifested by an increase of the latent period of conditioned reflexes in response to individual stimuli or all stimuli, and a partial or complete failure of these reflexes. It was also concluded that the nature, severity, and duration of disturbances of the higher nervous activity of dogs are determined by the individual characteristics of the animals. S.C.W.

N65-23445 Joint Publications Research Service, Washington, D. C.
THE EFFECT OF SOUNDS AND PHOTIC STIMULI LASTING FOR A LONG PERIOD OF TIME ON DEVELOPMENT OF AN EXPERIMENTAL ATHEROSCLEROSIS IN FEMALE RABBITS
I. D. Nasledova and Ya. D. Rafal'skiy *In its* Transl. from Patol. Fiziol. i Eksperim. Terapiya (Pathological Physiol. and Exptl. Therapy), Vol. VIII, No. 6, 1964 20 Apr. 1965 22–25 refs (See N65-23443 13-04) CFSTI: $2.00

Experiments were performed on mature and immature female rabbits to study the effects of age and continuous sound and photic stimuli on the development of nutritional cholesterol atherosclerosis, and to determine the role of the central nervous system (CNS) in the pathogenesis of atherosclerosis. Animals receiving cholesterol served only as the control. In sexually mature female rabbits, the prolonged action of alternating sound and photic stimuli resulted in a reduction of cholesterinemia and of the cholesterol–phospholipid ratio, and delayed the development of atherosclerosis of the aorta. These conditions were not observed in immature rabbits; however, an increase of cholesterinemia and the cholesterol–phospholipid coefficient in comparison to the control group was observed. The lipid indexes of the blood serum in immature rabbits subjected to photic and sound stimuli did not differ from those of the control group. No difference in the degree of manifestation of atherosclerosis of the aorta was found in either the experimental or control immature rabbit groups. It is assumed that the stimuli used caused impairments in the activity of the CNS in mature rabbits which led to the development of experimental atherosclerosis. S.C.W.

N65-23446# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS FROM MEDITSINSKAYA PROMYSHLENNOST' SSSR (USSR MEDICAL INDUSTRY), VOLUME 18, NO. 12, 1964
6 May 1965 22 p Transl. into ENGLISH from Med. Prom. SSSR (Moscow), v. 18, no. 12, 1964 p 3–5, 18–22, 48–49, 52–53
(JPRS-29954; TT-65-30929) CFSTI: $1.00

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3. TELEELECTROCARDIOGRAPH TEK-1 ON UNIVERSAL POWER SUPPLY A. N. Lebed' p 13–16 (See N65-23347 13-04)

4. ON THE HISTORY OF INVENTION OF A RADIOPROBE FOR THE DETECTION OF FOREIGN BODIES N. P. Fedotov p 17–19 (See N65-23448 13-04)

N65-23447 Joint Publications Research Service, Washington, D. C.
TELEELECTROCARDIOGRAPH TEK-1 ON UNIVERSAL POWER SUPPLY
A. N. Lebed' *In its* Transl. from Med. Prom. SSSR (USSR Med. Ind.), Vol. 18, No. 12, 1964 6 May 1965 p 13–16 (See N65-23446 13-04) CFSTI: $1.00

The basic circuit of the If amplifier of the teleelectrocardiograph TEK-1 instrument was redesigned in order to eliminate inherent problems in the storage battery from which the stationary part of the instrument obtains its power. The design is based on the combined operation of a universal power network and a storage battery. Results show that the combined power supply increased the reliability of the instrument. S.C.W.

N65-23448 Joint Publications Research Service, Washington, D. C.
ON THE HISTORY OF INVENTION OF A RADIOPROBE FOR THE DETECTION OF FOREIGN BODIES

N. P. Fedotov *In its* Transl. from Med. Prom. SSSR (USSR Med. Ind.), Vol. 18, No. 12, 1964 6 May 1965 p 17–19 (See N65-23446 13-04) CFSTI: $1.00

A synopsis on the development and use of radioprobes in military medicine for the detection of bullets, metallic fragments of mines and shells, and other foreign bodies, is presented. The further development and introduction of radioprobes into surgical practice, is advocated. S.C.W.

N65-23450 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRIMARY AND INITIAL PROCESSES IN THE BIOLOGICAL EFFECTS OF RADIATION Selected Articles

29 Jan. 1965 374 p refs Transl. into ENGLISH from the publ. "Pervichnyye i Nachal'nyye Protsessy Biologicheskogo Deystviya Radiatsii" Moscow, Akad. Nauk SSSR, 1963 p 1–44, 53–156, 192–201, 214–233, 243–270, 277–278 Symp. Papers

(FTD-TT-64-515/1+2; AD-611045)

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2. PRIMARY MECHANISMS OF RADIOBIOLOGICAL DAMAGE IN AEROBIC AND ANAEROBIC SYSTEMS L. H. Gray p 30–56 refs (See N65-23452 13-04)

3. EFFECT OF RADIATION ON PROTEINS AND NUCLEIC ACIDS IN SOLUTION AND ON INTERFACES A. G. Pasynskiy p 57–73 refs (See N65-23453 13-04)

4. EFFECT OF X-RAYS ON INTRACELLULAR BACTERIOPHAGE FORMATION F. Hercik p 74–81 refs (See N65-23454 13-04)

5. EFFECT OF IONIZING RADIATION ON PROTEIN SYNTHESIS IN THE CELL E. Pollard p 82–101 refs (See N65-23455 13-04)

6. CHEMICAL STATES ARISING IN CELLS DURING X-IRRADIATION AND THEIR ROLE IN RADIATION DAMAGE E. L. Powers p 102–123 refs (See N65-23456 13-04)

7. FLUORESCENCE INVESTIGATIONS OF THE CHANGES IN NUCLEOPROTEINS AND THEIR DERIVATIVES IN IRRADIATED CELLS M. N. Meysel', Ye. M. Brumberg, T. M. Kondrat'yev, and I. Ya. Barskiy p 124–149 refs (See N65-23457 13-04)

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9. EFFECT OF X-RAYS AND AMINO ACID ANALOGS ON THE SYNTHESIS OF DNK AND ON THE NUCLEAR PROTEIN, DETERMINED IN THE SAME TISSUE B. E. Holmes p 158–169 refs (See N65-23459 13-04)

10. RADIATIVE DESTRUCTION OF LIPIDS IN THE CELL MICROSTRUCTURES N. N. Demin and B. D. Blokhina p 170–184 refs (See N65-23460 13-04)

11. THE ROLE OF FREE DEOXYRIBONUCLEOTIDES IN THE ORIGIN OF RADIATION INJURY J. Soska, L. Benes, V. Drasil, Z. Karpfel, E. Palecek et al p 185–198 refs (See N65-23461 13-04)

12. BIOCHEMISTRY AND RADIOBIOLOGY OF THE CELL NUCLEUS M. Errera p 199–209 refs (See N65-23462 13-04)

13. ON THE MECHANISM OF THE LETHAL EFFECT OF X-RAYS ON ESCHERICHIA COLI A. Marcovich and R. Vain p 210–223 refs (See N65-23463 13-04)

14. IMPAIRMENT OF THE REPRODUCTIVE CAPACITY OF HUMAN CELLS IN TISSUE CULTURES BY THE EFFECT OF IONIZING RADIATION WITH DIFFERENT LINEAR ENERGY LOSS G. V. Barendsen p 224–240 refs (See N65-23464 13-04)

15. INITIAL STAGES OF RADIATION DAMAGE TO CHROMOSOMES AND METHODS OF THEIR PREVENTION A. Hollaender p 241–254 refs (See N65-23465 13-04)

16. INVESTIGATION OF ENZYMES AND YEAST CELLS BY MEANS OF ACCELERATED HEAVY IONS K. A. Tobias, T. Brustad, and T. Manney p 255–271 refs (See N65-23466 13-04)

17. INSTANTANEOUS REACTIONS OF NERVES AND MUSCLES TO IONIZING RADIATION O. Hug and G. I. Schliep p 272–288 refs (See N65-23467 13-04)

18. MECHANISM OF CHEMICAL RADIATION PROTECTION Z. M. Bacq and P. Alexander p 289–363 refs (See N65-23468 13-04)

N65-23451 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE NATURE OF INITIAL RADIATION DAMAGE ON A SUBCELLULAR LEVEL

D. A. Alexander and Z. M. Bacq *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 8–29 refs (See N65-23450 13-04)

The nature of initial chemical radiation damage in the cell, leading to its death, was studied. The effects of damage to chromosomes, cytoplasm, and the nucleus are discussed to determine whether visible structural damage necessarily precedes cell death. Radiation sensitivity, radiation sensitizers, and intracellular protective agents were studied to determine the mechanism of action of chemical radiation protection. The effects of damage to enzymes and nucleoproteins were studied to determine whether there are molecules or groups of molecules in which changes could be observed immediately after in vivo irradiation at dosages which produce important morphological changes after a long latent period. Injuries to the membranes and intracellular barriers which lead to biochemical disorders are also discussed. S.C.W.

N65-23452 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRIMARY MECHANISMS OF RADIOBIOLOGICAL DAMAGE IN AEROBIC AND ANAEROBIC SYSTEMS

L. H. Gray *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 30–56 refs (See N65-23450 13-04)

The loss of the reproductive capacity of cells in spores, vegetating bacteria, and cells of higher plants and animals is a result of damage to a small number of macromolecules, essential for the process of reproduction. A large number of data already exist concerning the nature and life of the intermediates of chemical reactions which result in damage to these macromolecules in dry spores. A slight moisture content greatly alters the course of the reactions and reduces the life of many intermediates. In cells with high moisture content, a considerable proportion of the damage may be due to the products of water radiolysis. The fate of individual forms of damage to macromolecules, arising, in particular, via chemical pathways, may be considerably modified by nutritional conditions prior to and after irradiation. The effect of the chemical factors and nutritional conditions is mutually connected. Author

N65-23453 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF RADIATION ON PROTEINS AND NUCLEIC ACIDS IN SOLUTION AND ON INTERFACES

A. G. Pasynskiy *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 57–73 refs (See N65-23450 13-04)

Chemical changes in irradiated protein molecules which lead to the oxidation of SH-groups, the breaking of peptide bonds, and desamination, are discussed. Emphasized is the transition of a large number of protein molecules into the excited or activated state which is accompanied by a regrouping of a part of the links of the polypetide chains and corresponding structural changes. The secondary importance of nucleic acids and nucleoproteins in initiating changes in the cell after irradiation, is discussed. Based on the theory of open systems it is concluded that damage to a few molecules in the internal interfaces may lead to a considerable change in the transport constant and to a disruption of biochemical processes in the cell, even where the bulk of the enzyme and substrate molecules remain unchanged. Reference is made to the importance of this factor to the mechanism of biological intensification of the radiation effect and to the theory concerning the biological effect of radiation. S.C.W.

N65-23454 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF X-RAYS ON INTRACELLULAR BACTERIOPHAGE FORMATION
F. Hercik *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 74–81 refs (See N65-23450 13-04)

The inactivation of the phage productivity of *E. coli B* for T-3 phage was investigated during the action of soft X-rays. The dose-effect curve is of a two-phase nature. At small doses rapid inactivation takes place, whereas at large doses the inactivation proceeds much slower. The phage productivity of irradiated *E. coli B* cells changes upon addition of chloroamphenicol to the culture medium. If chloroamphenicol is added to irradiated bacteria together with the phage during the lobarithmic phase, the decrease in phage productivity is less than would be the case if the effects of the two factors were cumulative. For cultures in the stationary phase, the protective effect of chloroamphenicol is less pronounced. Author

N65-23455 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF IONIZING RADIATION ON PROTEIN SYNTHESIS IN THE CELL
E. Pollard *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 82–101 refs (See N65-23450 13-04)

The aim is to obtain some information concerning the nature of protein synthesis by the use of the disrupting effect of ionizing radiation. The experiments agree with the concept that direct protein synthesis is carried out by organelles sensitive to the effect of ionizing radiation; this sensitivity is typical for ribonsomes in the uncoiled state. The volume of the sensitivity corresponds to the size of S80 ribosomes. The delayed radiation effect is much more difficult to ascertain; in separate experiments it was found that the rate of growth of the DNK in the irradiated cells decreases. This may mean that some sort of decomposition of the nucleus of the bacteria takes place, leading to upsetting of the equilibrium in the cell, and subsequently to a decrease in the synthesis activity of the cell. Author

N65-23456 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHEMICAL STATES ARISING IN CELLS DURING X-IRRADIATION AND THEIR ROLE IN RADIATION DAMAGE
E. L. Powers *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 102–123 refs (See N65-23450 13-04)

The radiation sensitivity of dry bacterial spores was studied under several experimental conditions to determine the role and nature of intracellular chemical changes taking place during irradiation. Considered are known chemical states, their interactions with oxygen, and the degree of their participation in biological damage caused by irradiation. Spores from *Bacillus megaterium* were used. Data on the effects of heat, nitric oxide, hydrogen sulfide, and oxygen, are presented. S.C.W.

N65-23457 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLUORESCENCE INVESTIGATIONS OF THE CHANGES IN NUCLEOPROTEINS AND THEIR DERIVATIVES IN IRRADIATED CELLS
M. N. Meysel', Ye. M. Brumberg, T. M. Kondrat'yev, and I. Ya. Barskiy *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 124–149 refs (See N65-23450 13-04)

The utilization of fluorescence microscopy in radiobiological research is discussed. Data on changes in nucleoproteins and their derivatives in irradiated cells of unicellular plant organisms, animal cell cultures in vitro, and cells of the hematopoietic organs of animals, are reported. Emphasized is the use of fluorescent dyes for vital and supravital investigations in the visible part of the spectrum, the use of ultraviolet to determine whether the nature of the ultraviolet fluorescence of organs and cells changes under the influence of ionizing radiation, and the application of ultraviolet fluorescence microscopy to the investigation of cytoplasm objects. S.C.W.

N65-23458 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHOSPHORUS METABOLISM IN THE NUCLEUS
L. A. Stocken *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 150–157 refs (See N65-23450 13-04)

A review of the possible interrelations of fundamental biochemical processes with DNK (deoxyribonucleic acid) synthesis in animal cells and an attempt to discuss to what degree, in the light of present knowledge, X-irradiation interference in DNK synthesis can be explained, is presented. Phosphorus metabolism in rat thymus nuclei was studied. Low doses of irradiation caused a local disruption of the organized system of the nucleus which resulted in a modification of all processes. The problem of what processes or structures support the organized state of the nucleus was investigated. When the nuclei were isolated in an ionic or saccharose medium, the fraction of inorganic and organic phosphate remained bound in the nucleus. These phosphates were liberated only in acid medium or by such strong mechanical damage that the integrity of the nuclear structure was completely destroyed. The inorganic phosphate outside the nucleus does not affect the phosphorylation of monucleotides. The specific activity of inorganic phosphate in the microsomes is approximately the same as in the cell fluid, but in the mitochondria it is less than in the nucleus. S.C.W.

N65-23459 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF X-RAYS AND AMINO ACID ANALOGS ON THE SYNTHESIS OF DNK AND ON THE NUCLEAR PROTEIN, DETERMINED IN THE SAME TISSUE
Barbara E. Holmes *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 158–169 refs (See N65-23450 13-04)

A simultaneous study on the effects of irradiation and amino acid analogs on nucleic acid synthesis and residual

protein synthesis in rat liver cells, is reported. Results of studies on the effects of irradiation on the incorporation of amino acid into nuclear protein showed that large doses of X-rays produced 50% synthesis inhibition which served to slow down the rate of synthesis. The complete synthesis of nucleic acids was formed in irradiated cells. Irradiation inhibited nucleic acid synthesis without inhibiting the synthesis of a specific protein fraction. In normal cells, the synthesis of this fraction took place simultaneously with nucleic acid synthesis. It is concluded that X-rays caused some interference with the interrelations between these two processes. The nature of the damage caused by irradiation to the nucleoprotein complex of the cell was not determined. S.C.W.

N65-23460 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RADIATIVE DESTRUCTION OF LIPIDS IN THE CELL MICROSTRUCTURES

N. N. Demin and B. D. Blokhina *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 170–184 refs (See N65-23450 13-04)

The effects of radiation damage to lipid complexes in cell organelles and their metabolism, were studied. Data on the quantitative relationships between different lipid fractions in whole cytoplasm and separately in the hyaloplasm of rabbit liver cells subjected to Co^{60} gamma rays, are presented. Results demonstrate that during the development of radiation disease, a slowing down in the degeneration of lipoproteins in the cytoplasmic organelles as well as in the hyaloplasm of cells takes place, which is later replaced by it intensification in the cytoplasm organelles with decrease in the capacity to bind the available free lipids. The strongly bound lipids proved to be more stable in the hyaloplasm. Under the same irradiation conditions, studies were made on the mucosa of the small intestine in an attempt to investigate mitochondria and microsomes. Radiation injury led to marked changes in the lipid composition of the morphological cell components in the mucosa. Results of these studies are compared with those derived from studies on liver cells. S.C.W.

N65-23461 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROLE OF FREE DEOXYRIBONUCLEOTIDES IN THE ORIGIN OF RADIATION INJURY

J. Soska, L. Benes, V. Drasil, Z. Karpfel, E. Palecek et al *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 185–198 refs (See N65-23450 13-04)

Data on the effect of deoxynucleotides on mitosis; the capacity of deoxynucleotides and embryonic extract to intensify DNK (deoxyribonucleic acid) synthesis, which is inhibited by irradiation; and the changes in the content of free deoxynucleotides and deoxynucleosides in regenerating liver after irradiation, are presented. On the basis of these data, it is concluded that the effects of radiation on the processes which result in DNK synthesis are more significant in animals, than radiation effects on the process of polymerization or the structure of macromolecular DNK. S.C.W.

N65-23462 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BIOCHEMISTRY AND RADIOBIOLOGY OF THE CELL NUCLEUS

M. Errera *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 199–209 refs (See N65-23450 13-04)

A summary of existing data relating to normal biochemical processes taking place in the nucleus and an analysis of physicochemical and biochemical changes induced by radiation damage to nuclei, is presented. Data on deoxyribonucleic acid synthesis, protein synthesis, and the role of ionic equilibrium in the metabolism of thymocyte nuclei, are included. S.C.W.

N65-23463 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE MECHANISM OF THE LETHAL EFFECT OF X-RAYS ON ESCHERICHIA COLI

A. Marcovich and R. Vain *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 210–223 refs (See N65-23450 13-04)

The lethal effects of irradiation on *Escherichia coli* are investigated to determine whether dominant lethal mutations arise in the genetic material. Data on the survival curve of the recombinations of HfrH and T^+L^+Sr, survival curves of the recombinations T^+Sr, L^+Sr and T^+L^+Sr, the influence of interrupted conjugation on the viability of T^+L^+Sr recombinations, crossing between irradiated Hfr bacteria and normal F^- bacteria grown on a nonselective medium, and hybridization between the irradiation F^- bacteria and the normal or irradiated Hfr bacteria, are presented. Results of these experiments showed no induction of dominant lethal mutations in the chromosome material of the cells of strain Hfr. By means of selected markers it was shown that the F^- cells can have a favorable effect on the characteristics of the irradiated males. Irradiation damage does not affect the genetic information but mainly the mechanism of transfer of the selected markers to the recombinations. As lethal dominants were not detected by the method of recombinations, two alternative hypotheses are suggested for elucidating the exponential nature of the dependence of the lethal effect of radiation on *E. coli* on the dose. S.C.W.

N65-23464 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

IMPAIRMENT OF THE REPRODUCTIVE CAPACITY OF HUMAN CELLS IN TISSUE CULTURES BY THE EFFECT OF IONIZING RADIATION WITH DIFFERENT LINEAR ENERGY LOSS

G. V. Barendsen *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 224–240 refs (See N65-23450 13-04)

The effects of radiation with different linear energy losses on the proliferating capacity of tissue cultured human kidney cells, were studied. When alpha irradiation was used, the survival curve was of an exponential nature, while for radiation with low linear energy loss, the survival curve was of a more complex nature. Studies of the effect of fractional irradiation showed that after X-ray or beta radiation, partial restoration takes place. Restoration was not observed after alpha irradiation. The effect of different doses of alpha radiation with subsequent or preceding X-irradiation was also studied. The X-rays acted on the survival of the cells after alpha irradiation in the same way as if the cells had not been previously irradiated. Opposite results were obtained using two separate doses of X-irradiation. In this instance, the effect of the second dose depended on the magnitude of the first, thus, a certain cumulative effect is observed. It was shown that the effect of oxygen on the radiation sensitivity of these cells was considerably less during alpha irradiation than when using X-rays. S.C.W.

N65-23465 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INITIAL STAGES OF RADIATION DAMAGE TO CHROMOSOMES AND METHODS OF THEIR PREVENTION

A. Hollaender *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 241–254 refs (See N65-23450 13-04)

The initial stages of radiation damage to cytological and genetic material, and methods of preventing radiation damage were studied. Two different approaches were used which consisted of decreasing the radiation dose to elucidate the effects and evaluating them quantitatively, and elucidating the possibilities of protection against the effect of radiation. Results of studies on the effect of small radiation doses on the frequency of mitoses; the synergistic effect of small doses of combined X-rays and ultraviolet; and a combined study on the use of chemical substances as protective agents, and the possibility of assisting in the restoration of radiation damage to the cell before this damage is fixed or gives rise to a chain reaction, are presented. It is surmised that by studying the survival rate of living cells, the duration of mitosis, the nature of chromosome breakages, and the appearance of mutations, all stages, from the initial absorption of radiant energy up to the final breakage of chromosomes, the recombination of chromosome fragments, or the appearance of mutations can be traced. S.C.W.

N65-23466 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF ENZYMES AND YEAST CELLS BY MEANS OF ACCELERATED HEAVY IONS
Kornelius A. Tobias, Thor Brustad, and Thomas Manney *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 255–271 refs (See N65-23450 13-04)

The effect of heavy accelerated ions, such as protons, alpha particles, ions of boron-10, carbon-12, nitrogen-14, oxygen-16, neon-20, and argon-40, on living cells and biogically important molecules was studied. Results of studies on the effects of irradiation on dehydrated enzyme molecules in the dry state, and studies with yeast cells to determine whether the liquid medium of the nucleus is capable of modifying the effect of heavy ions are presented. Also included is an analysis of the inhibiting effect of radiation on cell division in *Saccharomyces cerevisiae*. S.C.W.

N65-23467 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSTANTANEOUS REACTIONS OF NERVES AND MUSCLES TO IONIZING RADIATION
O. Hug and G. I. Schliep *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 272–288 refs (See N65-23450 13-04)

Isolated nerve–muscle preparations were used to investigate different parameters responsible for instantaneous reactions to ionizing radiation. Nerve/muscle preparations of leeches (*Hirudo med.*), the earthworm (*Lumbricus terr.*), and isolated leech muscles were studied. In nerve/muscle preparations two different effects were observed. If the preparation was in a state of spontaneous contraction, irradiation produced a temporary inhibition; and, conversely, in a state of relative rest, irradiation produced rhythmic contractions. There was a strict relationship between the effect and power of the dose and total irradiation dose. The effect of irradiation on a strip of the abdominal wall of the leech, which was completely isolated from the nerve chain, showed that the dose and power of the dose necessary to produce a reaction were considerably greater than in the case of the intact nerve/muscle preparation. Data on muscle relaxation inhibition by acidification, contraction produced by radiation in a muscle not capable of relaxation, the effects of single exposure at submaximum dose, and the reaction of a muscle preparation under conditions where the metabolic processes are undisturbed, are included. S.C.W.

N65-23468 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANISM OF CHEMICAL RADIATION PROTECTION
Z. M. Bacq and P. Alexander *In its* Primary and Initial Processes in the Biol. Effects of Radiation 29 Jan. 1965 p 289–363 refs (See N65-23450 13-04)

The role of cysteamine and related compounds as chemical protector substances against irradiation, was studied. In experiments with model systems, cysteamine proved capable of protecting animals by the following three methods: redistribution of absorbed energy, reduction of the damaged molecule, and temporary combination with the damaged molecule. The mechanism of protection of living mammalian systems was also studied. It is postulated that one or several mechanisms, in which free radicals participate, are more likely to be responsible for the protective properties of cysteamine in mammals. Protection through competition for free radicals and through reduction is possible in addition to direct energy transfer. The mechanism of reduction may play an important part because it explains why protection is more effective in aerobic cells. The exclusion of disulfide metabolism, tissue anoxia, and histamine, as the primary mechanisms of chemical protection, is discussed. S.C.W.

N65-23589# School of Aerospace Medicine, Brooks AFB, Tex. Dept. of Physiology
A NEW METHOD FOR THE MEASUREMENT AND EXPRESSION OF OXYHEMOGLOBIN DISSOCIATION CURVES
J. Ryan Neville and John J. Sasner Dec. 1964 18 p refs Submitted for Publication
(SAM-TR-64-75; AD-457236)

A continuous rapid plot of the shape of oxygen dissociation curves can be obtained with a single small sample of blood diluted in appropriate buffer. The method requires the continuous removal of oxygen (both dissolved and combined) via aerobic respiration of yeast in the dilute blood sample (20:1, pH 7.4) while simultaneously recording the PO_2 with a polarographic dropping mercury electrode (DME). Methods of analysis are presented for converting polarographic current-time records into oxyhemoglobin dissociation curves similar to those obtained by more classical technics. An alternative interpretation of the current-time curves in terms of the relative oxygen flux (ROF) to the DME is described. This results in dissociation curves giving meaningful expression to certain dynamic factors involved in oxygen transport to tissues, including diffusion and rates of reaction, which are not revealed by the classic thermodynamic relationship. Examples of such curves, relating percent saturation to ROF are presented and the theoretic aspects of the derivation discussed. Author

N65-23596# Atomic Energy Commission, Washington, D. C. Div. of Biology and Medicine
TERRESTRIAL AND FRESHWATER RADIOECOLOGY A Selected Bibliography (Supplement 3)
Alfred W. Klement, Jr. and Vincent Schultz Feb. 1965 119 p (TID-3910(Suppl. 3)) CFSTI: $2.50

This supplemental bibliography contains 1192 references related to field or laboratory studies of wild species of plants and animals with respect to radiation effects on metabolic studies involving radionuclides. Studies of laboratory strains or domestic strains are generally not included. G.G.

N65-23616# Flying Personnel Research Committee, London (England).
THE PRODUCTION OF RADIATION BURNS ON THE RETINA AT THE THRESHOLD LEVEL OF DAMAGE: A LITERATURE SURVEY AND TENTATIVE MATHEMATICAL THEORY
K. E. Spells Mar. 1964 41 p refs
(FPRC/1222)

Results of experiments to determine the threshold conditions for the production of burns on the retina of the eye by radiation were collected from the literature; all of the experimental work performed so far has been on rabbits. This survey covers experiments in which the exposures were long (minutes, or fractions thereof) and short (0.5 msec by lasers), and attempts to treat the problem theoretically were included within its scope. Working from a somewhat different set of assumptions than have been used in previous mathematical work on the subject, a tentative theory is presented for the production of threshold burns. This theory shows a measure of agreement with existing experimentally determined data which is encouraging, and its predictions include the case of threshold burn production by exposures of very brief duration (10 msec and below).
Author

N65-23645# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
METABOLISM OF RADIOIODIDE IN *CHLORELLA VULGARIS* [METABOLISMO DEL RADIOIODURO POR LA *CHLORELLA VULGARIS*]
Leopoldo J. Anghileri 1965 10 p refs In SPANISH
(Rept.-132)

Experiments were conducted to determine iodine metabolism in *Chlorella Vulgaris* in media containing radioactive iodine-131. More than 50% of the intracellular iodine absorbed was in the iodide state. Although the protein fraction contained a large part of the isotope, no quantitative values of the protein composition could be determined, as the iodide protein compounds proved unstable during hydrolysis. Charts showing the percentages of activity obtained by various extraction methods are given.
R.N.A.

N65-23678*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF MANUAL LABOR AND PERSPIRATION ON BLOOD AND TISSUE [UBER DIE EINWIRKUNG DER MUSKELARBEIT UND DES SCHWITZENS AUF BLUT UND GEWEBE]
W. Gross and O. Kestner May 1965 30 p refs Transl. into ENGLISH from Z. Biol. (Munich), v. 70, 1919 p 187–210
(NASA-TT-F-9338) CFSTI: HC $2.00/MF $0.50

Information is given on changes in the composition of blood and tissue as a result of strenuous muscular activity, i.e. hiking. Tests were carried out on dogs, rabits, small donkeys, and on human beings to ascertain water losses in the body, salt losses, and their effect on the body metabolism, in particular the blood and tissue. Tests were carried out on humans during a mountain climb in Italy under various conditions of weather, exertion, food intake, and perspiration. Under conditions of salt deficiency the body weight was measured prior to departure, upon arrival, on the following two mornings, and on the third day. Measurements were made of various factors before and after the trip (albumen in %, serum viscosity, hemoglobin count, body weight, body loss). Three types of water which are referred to as concentration water, reduction water, and destruction water, are differentiated, and the properties of each are discussed. Determinations were made to ascertain the water reservoirs of the body, such as the muscles. It is concluded that water and salt are only temporarily taken from the blood during manual labor and subsequent perspiration, and that salt intake is necessary to bring about full replacement of water lost through perspiration.
Author

N65-23729# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
THYROID CENTELLOGRAM [CENTELLOGRAMA TIROIDEO]
D. Artagaveytia, O. Degrossi, H. Gotta, and V. Pecorini 1964 14 p refs In SPANISH
(Rept.-129)

Thyroid nodules quite often hide malignant tumors, but because of the latter's greater affinity for iodine they can be distinguished by radiological comparisons of radioiodine absorption. This paper discusses the use of scintillograms in diagnosing thyroid tumors and presents statistical evidence from radiological studies on their effectiveness.
R.N.A.

N65-23742*# California Univ., Los Angeles. Brain Research Inst.
EFFECT OF SPACE ENVIRONMENT ON CIRCADIAN RHYTHMS OF PLANTS, FOR THE PURPOSE OF DEFINING AND VERIFYING AN EXPERIMENT SUITABLE FOR USE IN A BIOSATELLITE Final Report, Sep. 1, 1964–Feb. 28, 1965
J. D. French and T. Hoshizaki 28 Feb. 1965 8 p refs
(Grant NsG-528)
(NASA-CR-62707) CFSTI: HC $1.00/MF $0.50

An apparatus to simulate weightlessness condition for plants, NOGRAVATRON, was developed. An infrared time lapse photographic system, a strain-gage recording system which measures the movements of pinto leaves and whose signal is suitable for telemetry; and a prototype flight package for neurospora experiments were also developed. Response differences were found in growth rates and growth directions in barley seedlings grown in a simulated weightlessness condition. Leaf movement when the plant is stationary and grown under constant conditions was confirmed and delineated. Size of the experimental plant material was reduced. Leaf movements of pinto beans were found to respond to a simulated weightlessness condition by the loss of leaf movements or by a phase shift of the leaf movements. Basic 27-hour leaf movement rhythm was confirmed by computer analysis of photographic time lapse data.
Author

N65-23775# Joint Publications Research Service, Washington, D. C.
PROCESSING OF INFORMATION ON LIVING ORGANISMS. DISCUSSIONS ABOUT THE BRAIN
A. Napalkov and A. Turov 23 Apr. 1965 12 p Transl. into ENGLISH from Nauka i Zhizn' (Moscow), no. 9, Sep. 1964 p 68–72
(JPRS-29744; TT-30815) CFSTI: $1.00

Data on the arrangement and functioning of receptors and analyzers, systems perceiving and developing information on the condition of the external environment, the condition of the external environment and the internal medium of the organism, and the evolutionary position of the organism, are presented. Discussed are the echo-locating apparatus of the bat, the proprioreceptive sensing device of the praying mantis, the mechanoreceptors of Arthropoda and the *Calliphora* fly, the labellum bristles of flies, and thermoreceptors of rattlesnakes. Results of physiological experiments on the frog show that, by means of the visual analyzer, it is able to recognize definite moving figures in its environment and to classify them as useful, harmful and indifferent. An electron model of this apparatus confirmed the correctness of these experiments.
S.C.W.

N65-23776# Joint Publications Research Service, Washington, D. C.
INDUSTRIAL TOXICOLOGY
E. B. Kurlyandskaya et al 10 May 1965 36 p refs Transl. into ENGLISH from Gigiena Truda i Prof. Zabolevaniya (Moscow), no. 3, Mar. 1965 p 3–15, 38–43, 60–63
(JPRS-29981; TT-65-30939) CFSTI: $2.00

CONTENTS:

1. THE CRITERIA OF NOXIOUSNESS DURING STANDARDIZATION OF CHEMICAL CONTENT IN THE AIR OF INDUSTRIAL PLANTS E. B. Kurlyandskaya and I. V. Sanotskiy p 1–9 refs

2. STUDY OF CENTRAL NERVOUS SYSTEM FUNCTION DURING TOXICOLOGICAL EXPERIMENTS M. Khorvat, E. Frantik, F. Korzhinek, A. Mikiska, and G. Mikiskova p 10–19 refs

3. EXPERIMENTAL TREATMENT AND PROPHYLAXIS OF ACUTE ARSENIC POISONING I. Ye. Okonishnikova p 20–27 refs

4. TRACING OF PHENOLS IN THE ATMOSPHERE K. K. Dushutin and Yu. A. Manyashin p 28–29

5. THE FIRST CONFERENCE IN MOSCOW OF THE HEADS OF ORGANIZATIONAL AND METHODOLOGICAL DEPARTMENTS OF INSTITUTES OF INDUSTRIAL HYGIENE AND OCCUPATIONAL DISEASES (MARCH 1964) N. I. Vokova p 30–33

N65-23777# Joint Publications Research Service, Washington, D. C.

SOME MEDICAL, PSYCHOPHYSIOLOGICAL, AND TECHNICAL ASPECTS OF SPACE FLIGHT

V. Parin et al 11 May 1965 13 p Transl. into ENGLISH from Med. Gazeta (Moscow), 23 Mar. 1965 p 2
(JPRS-29998; TT-65-30950) CFSTI: $1.00

CONTENTS:

1. MEDICINE AND OUTER SPACE V. Parin p 1–4
2. GROUP PSYCHOPHYSIOLOGY F. Gorbov p 5–7
3. SPACE SUITS V. Krichagin p 8–10

N65-23793*# National Aeronautics and Space Administration, Washington, D. C.

THE DEPENDENCE OF DIURESIS ON THE SALT CONTENT AND HYDROGEN ION CONCENTRATION OF DRINKING WATER [UBER DIE ABHANGIGKEIT DER DIURESE VOM SALZGEHALT UND DER WASSERSTOFFIONENKONZENTRATION DES GETRUNKENEN WASSERS]

E. Starkenstein May 1965 23 p refs Transl. into ENGLISH from Arch. Exptl. Pathol. Pharmakol. (Berlin), v. 104, 1924 p 6–22
(NASA-TT-F-9337) CFSTI: HC $1.00/MF $0.50

This paper explains tests to determine the amount of urine excreted from different types of mineral waters and ordinary waters taken into the organism. Tests were made of a variety of German mineral waters and, were carried out on rabbits, dogs and man. Distilled water, sodium chloride solutions, tap water and various mineral waters were tested and the amount of excretion in ccm was measured during a 4-hour period from 1 liter of the liquid which was imbibed. Amount of urine excretion was found to depend upon the salt content of the liquid, the free carbon dioxide, the alcohol content, and the hydrogen ion concentration, among other factors. Salt content inhibits excretion; carbon dioxide stimulates it. The diuresis-stimulating effect of carbon dioxide is primarily due to the hydrogen ion concentration. Author

N65-23813*# General Technical Services, Inc., Yeadon, Pa.

FURTHER STUDY OF THE DYNAMIC SYSTEMS RESPONSE OF SOME INTERNAL HUMAN SYSTEMS

A. S. Iberall and S. Z. Cardon Washington, NASA, May 1965 179 p refs
(Contract NASw-1066)
(NASA-CR-219) CFSTI: HC $5.00/MF $1.00

A contribution is made toward a new theory of automatic control as a background for analysis of the entire biological system. Author

N65-23841# School of Aerospace Medicine, Brooks AFB, Tex.

GAS CHROMATOGRAPHIC DETERMINATION OF SMALL VOLUMES OF NITROGEN DISSOLVED IN BLOOD Final Report, Jun.–Dec. 1964

Kenneth G. Ikels Mar. 1965 12 p refs
(SAM-TR-65-6; AD-460797)

A gas chromatographic method, in conjunction with a modified Van Slyke apparatus, is described for the determination of small volumes of N_2 dissolved in blood. Essentially, the method consists of the extraction of a sample under reduced pressure followed by the absorption of O_2 and CO_2. The remaining gas, chiefly N_2, is quantified by gas chromatography. The observed Bunsen absorption coefficient for N_2 in blood agrees closely with the values reported in literature. The method is accurate to within 0.3 μ l of N_2 gas. The method is suitable for use throughout the physiologic range of dissolved N_2 which could be encountered in nitrogen elimination studies. Author

N65-23889# New York Eye and Ear Infirmary, N. Y.

LARGE RETINAL BURN STUDY

Harold Najac, Blossom Cooper, Leo Todman, and James C. Newton Philadelphia, Frankford Arsenal, Dec. 1964 21 p
(Contract DA-36-038-AMC-685(A))
(R-1747; AD-456515)

Some tentative values are given for the threshold doses associated with minimal retinal lesions for typical large image diameters (4 and 6 mm). A pulsed xenon source was used with exposure times varying between 20 and 100 milliseconds and irradiance levels between 10 and 30 cal/cm^2 sec. Author

N65-23936 Technische Hochschule Aachen (West Germany). Deutsches Wollforschungsinstitut

ON THE DECOMPOSITION OF POLYESTER FIBERS THROUGH HYDROLYSIS AND AMINOLYSIS [UBER DEN ABBAU VON POLYESTERFASERN DURCH HYDROLYSE UND AMINOLYSE]

Heimo Pfeifer Cologne, Westdeut. Verlag, 1964 119 p refs In GERMAN Forschungsber. des Landes Nordrhein-Westfalen No. 1212

Alkaline hydrolysis of polyester fibers did not support earlier findings that the observed weight loss is a linear function of time, but rather an exponential function of time resulting in a lattice expansion pattern of the decomposing fiber. Polyester decomposition by aminolyses produced pure amides and the synthesis of two model substances yielded the bis-benzylamid and mono-ethylendiamid of the terephthalic acid. Hydraulic decomposition of the polyester fibers in water of 100° to 150°C under pressure showed a definite tensile loss. Organic solvents at higher temperatures had a fixation effect on the fibers. Exposure to xenon photolyses for 10 weeks decreased absolute hardness 75% and tensile strength 76%. Neutron radiation resulted in marked fiber damage with linear decrease of molecular weight but no lattice expansion pattern was observed in the leftover fibers. Transl. by G.G.

N65-23941# Agricultural Research Service, Watkinsville, Ga.

RESEARCH IN PLANT TRANSPIRATION: 1962 Production Research Report No. 87

James E. Pallas, Jr., Anson R. Bertrand, Donald G. Harris, Charles B. Elkins, Jr., and Clyde L. Parks Mar. 1965 56 p refs Prepared in cooperation with Ga. Agr. Expt. Sta. and U. S. Army Electron. Res. and Develop. Activity GPO: $0.45

In a controlled environment growth room, radiant energy, relative humidity, and soil moisture tension had marked effects on the transpiration rate of plants. Guard cell operation was affected by moisture availability. Osmotic pressure determinations made concurrently with stomatal observations showed that, with the species studied, operation of stomata could not be correlated with changes in osmotic pressure of the guard cells. Tests were made of several formulations applied to leaves to provide either a physical barrier to transpiration or a potential control of stomatal operation. Materials included latex and plastic compounds, waxes, mercury and fluoride compounds, and α-hydroxysulfonates. Although a number of these formulations reduced transpiration, few did so without also depressing plant growth. In experiments with the most effective transpiration suppressants, treated leaves developed a temperature differential of 6° to 10° C, over that of untreated leaves. Author

N65-23980*# Minnesota Univ., Minneapolis.
PROCEEDINGS OF THE ATMOSPHERIC BIOLOGY CONFERENCE
Lucille H. Sukalo, ed. [1965] 244 p refs Conf. held at Minnesota Univ., 13–15 Apr. 1964
(Grant NsG-461)
(NASA-CR-62786) CFSTI: HC $6.00/MF $1.50

Conference papers on atmospheric biology are presented. For individual titles see N65-23981–N65-24000.

N65-23981* Minnesota Univ., Minneapolis. School of Physics
THE ATMOSPHERIC ENVIRONMENT
H. T. Mantis *In its* Proc. of the Atmospheric Biol. Conf. [1965] p 1–10 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Atmospheric properties of temperature, density, and the accompanying field of radiation as related to the biological environment are discussed. Natural injection of biological material at base of atmosphere will be determined by a complex interaction of properties of the biological material itself and particular characteristics of atmosphere at surface of earth. Extreme variability of atmospheric surface layer is emphasized. While it is predicted, therefore, that for most pollens and spores there would be a rapid decrease in concentration with altitude, particles approaching micron size might be expected in concentration at tropopause almost half as great as near surface. Some additional environmental hazards encountered by small particles at high altitudes will be discussed. Author

N65-23986* California Univ., Berkeley. Space Sciences Lab.
DETECTION AND STUDY OF MICROBIAL POPULATION IN UPPER ATMOSPHERE. SIMULATED HIGH ALTITUDE MICROBIAL SAMPLING WITH AN ELECTROSTATIC PRECIPITATOR
David Nicholson, William J. Oswald, and Robert C. Cooper *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 69–78 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

In the study of microorganisms that might exist in the upper atmosphere, a method of capturing such microorganisms in viable form is required. Theoretical studies indicated that a high collection efficiency could be attained with an electrostatic precipitator under near vacuum conditions. Experimental verification of the theoretically high efficiency of the precipitator and of the viability of organisms captured was sought through use of a laboratory aerosol chamber. In the chamber, suspensions of *Serratia marcescens* were established with atomizing equipment. An airstream drawn from the chamber was passed through the precipitator and through an Andersen sampler in parallel. The collected material was regrown and enumerated to evaluate the collector efficiency as compared with the Andersen. Many more viable organisms were collected in the Andersen than in the precipitator. With a second Andersen in series following the precipitator in the airstream, it appeared that the precipitator removed many more bacteria than could be enumerated as viable. On the basis of the limited evidence presented, it is tentatively concluded that *S. marcescens* was to a large extent killed during collection in the electrostatic precipitator. The killing mechanism (perhaps ozone production in the corona discharge of the precipitator) is under study. Studies are also in progress to modify the precipitator to increase its efficiency. Author

N65-23987* California Inst. of Tech., Pasadena.
PARAMETERS FOR BIOCOLLOIDAL MATTER IN THE ATMOSPHERE
Alexander Goetz *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 79–97 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Parameters can be derived from properties of aerocolloidal matter in general. Of the particulates to be considered more or less permanent atmospheric constituents, the upper size limit lies for the biosphere at kinetic (Stokes') diameters ($5\mu \leq d \leq 8\mu$), but decreases rapidly with altitude, whereas the lower limit for stable particulates of significant frequency appears to be at ($d \sim 0.05\mu$). This size range embraces, thus, about two decades and includes bacterial cells, spores, and virus-like forms, but excludes from permanent suspension pollen, seeds, etc. Aerocolloidal matter in the average represents but 10^{-7} to 10^{-8} of suspending gas mass and amounts to a numerical concentration of 10^6 to $10^{10}/m^3$ of which the biocolloidal components can be assumed to be only a minute fraction ($\leq 10^{-5}$). Constitution of natural aerocolloids—particularly regarding their organosoluble and thermally metastable components—is discussed and illustrated. Author

N65-23990* Mainz Univ. (West Germany).
LARGE-SCALE DISTRIBUTION OF MICROORGANISMS IN ATMOSPHERE
C. E. Junge *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 117–125 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Microorganisms in atmosphere can be represented by particles of Stokes' radii of about 1 micron and larger. Large scale distribution of such particles in troposphere and stratosphere is discussed. Conclusions for troposphere, based on considerations of physical processes involved and on studies of inorganic aerosols seem in line with information for atmospheric microorganisms. For stratosphere the vertical distribution of particles is calculated for sedimentation–diffusion equilibrium under various assumptions about the eddy diffusion coefficient. It is concluded that even larger microorganisms can penetrate into lower 10 km of the stratosphere. However an upward penetration of microorganisms beyond 25 km, in extreme cases beyond 30 km, can hardly be expected even for the smallest atmospheric microorganisms. Exposure of microorganisms to ozone and sulfur oxidation products in stratosphere is briefly discussed. Author

N65-23991* Woods Hole Oceanographic Institution, Mass.
BIOLOGICAL SIGNIFICANCE OF BACTERIAL COUNTS IN AQUATIC ENVIRONMENTS
Holger W. Jannasch *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 127–132 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50
(Grant NSF G-861)

Some recent marine bacteriological studies are discussed with regard to adequacy of techniques and possibility of an ecologically significant interpretation of counts obtained. It is concluded that to obtain statistically significant counts of any specific metabolic type of bacterium presupposes knowledge of growth requirements, germination properties, and extent of clumping and overgrowth. While under such conditions bacterial counts represent fair estimates of concentration of these organisms (regardless of their physiological state), they are not acceptable as an adequate measure of bacterial activity in natural populations. New approaches, employing continuous and semicontinuous growth systems, are promising more realistic estimates of bacterial activity in vivo. Author

N65-23992* Michigan Univ., Ann Arbor. Dept. of Botany
ATMOSPHERIC PARTICULATE MATTER OF PLANT ORIGIN
William S. Benninghoff *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 133–145 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Particulates of plant origin are grouped in following categories. (1) small, lightweight propagules; (2) single- or few-celled plant bodies or fragments; (3) deciduous tissue parts from plant surfaces; and (4) fragments of vegetable humus. Different kinds of particles in categories (1) and (2) remain viable in the lowest level of atmosphere for widely different time periods. Both living and nonliving particles are possible agglomeration nuclei or in some instances substrates for smaller parasitic or saprophytic organisms. Plant origin particulates can be recovered from atmosphere near ground by static samplers, dynamic samplers, and devices for entrapping rain washout. Results of static sampling to obtain pollen spectra of modern vegetation are discussed. Phytogeographical studies of seed and spore dispersal provide indications of transport distances. Geographic distributions of source plants for given kinds of particulates and distributions of different vegetation types determine patterns of sources from which air movements transport particulates. Source patterns are complex in detail because of habitat differences, and vary with seasons and with shorter term weather sequences. Author

N65-23993* Minnesota Univ., Minneapolis. Dept. of Botany
LONG-TERM ANALYSIS OF ATMOSPHERIC POLLEN
Agnes Hansen and A. Orville Dahl *In its* Proc. of the Atmospheric Biol. Conf. [1965] p 145–150 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Detailed analysis of airborne pollen has been carried on continuously since 1932. At that time a pilot operation was instituted after considerable observation of anemophilous species in the field. Pollen of many species from 50 different genera occur each season on the sampling slides. The 10 most abundant kinds of airborne pollen, in order of decreasing importance are these: *Ambrosia* (ragweeds), *Artemisia* (wormwood-sage), Gramineae (grass), Chenopodiales (Russian thistle, pigweeds), *Rumex* (dock), *Quercus* (oaks), *Ulmus* (elms), *Betula* (birches), and *Urtica* (nettles). Such factors as precipitation, wind direction, and temperature, influence the record of pollen on the sampling slide. The data of the highest 24-hour concentration of any specific kind of pollen varies over the years. The range in total seasonal concentration of pollen (expressed as number of pollen grains per square centimeter of surface of the sampling slide) may vary extensively. Author

N65-23994* Bernice P. Bishop Museum, Honolulu, Hawaii. Dept. of Entomology
AIRPLANE TRAPPING OF ORGANISMS AND PARTICLES
E. P. Holzapfel and J. L. Gressitt *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 151–163 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

An air plankton trap for operation on a Super Constellation aircraft was developed. During 3 years of operation 59 arthropods plus numerous fragments were collected over the Antarctic, Pacific, and continental United States. Plant and mineral material have also been collected and analyzed. The trap has been operated about 668 500 km (415 260 statute miles). Collecting results and inflight tests indicated low efficiency. Author

N65-23995* Rothamsted Experimental Station, Harpenden (England).
PROBLEMS OF SAMPLING FOR ATMOSPHERIC MICROBES
P. H. Gregory *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 165–169 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Technical difficulties of sampling in the upper air are posed by (1) the large volumes to be tested; (2) aerodynamical problems of removing particles with standard equipment not designed for high intake speeds; (3) problems of retaining viability after capture; (4) limiting contamination during passage through the lower atmosphere and in the laboratory; (5) recognition of contaminants. Author

N65-23996* Army Biological Labs., Fort Detrick, Md.
SAMPLING MICROBIOLOGICAL AEROSOLS IN THE LOWER ATMOSPHERE
Charles R. Phillips and Herbert M. Decker *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 171–177 ref (See N65-23980 13–04) CFSTI: HC $6.00/MF $1.50

Experience has been obtained in lower atmospheric sampling for viable airborne microorganisms outdoors and indoors. A large number of sampling devices have been developed for this purpose, many of which are not directly adaptable to low temperatures and low pressures that exist in upper atmosphere. Author

N65-23997* Illinois Univ., Urbana. Dept. of Microbiology
CAN SPORES SURVIVE SPACE TRAVEL?
H. O. Halvorson and V. R. Srinivasan *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 179–185 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Roles of calcium and dipicolinic acid in contributing heat resistance to spores and also resistance to desiccation are discussed. Spores' limits of tolerance to heat, and stability of this tolerance during storage, are studied. That the resistance of the spore is related to its affinity for water, brings into focus the question of the role of bound water in spore resistance to desiccation. If the water in spores is bound or if the spores are dry in presence of water is discussed. Spores are more resistant than vegetative cells to radiation. Organic compounds containing disulfide bonds such as found in cystine confer limited protection to biological materials against irradiation. Bacterial spores have been shown to possess macromolecules rich in cystine-like structures. The kinetics of incorporating radioactive S^{35} into cystine-like structures during sporulation indicates that the increase in cystine-rich structures corresponds with the increase of the radioresistance of the cell. Author

N65-23998* California Univ., Berkeley. School of Public Health
AN APPROACH TO STUDY OF MICROFLORA IN ATMOSPHERE
R. L. Dimmick and R. J. Heckly *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 187–197 refs Sponsored by ONR (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Holding suitable organisms in controlled atmospheric conditions and studying their viability for the purpose of extrapolating to natural conditions is discussed. These are general techniques employed in study of microorganisms in contact with the atmosphere: (1) In aerobiological techniques, cultures are aerosolized into chambers under controlled conditions, air is sampled, and survival studied. (2) In freeze-drying techniques, cultures are frozen at various temperatures and placed in a high vacuum until the moisture content has been reduced to between five % and some unknown lower limit. (3) In surface drying techniques (desiccation), cultures are painted onto surfaces, then exposed to a variety of atmospheric conditions. Author

N65-23999* Litton Systems, Inc., St. Paul, Minn. Applied Science Div.

MICROBIOLOGICAL EXPLORATION OF STRATOSPHERE RESULTS OF SIX EXPERIMENTAL FLIGHTS

V. W. Greene, P. D. Pederson, D. A. Lundgren, and C. A. Hagberg *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 199–212 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

(Contracts NASr-81; NASw-648)

Several balloonborne probes were launched to determine existence and identity of viable microorganisms at altitudes between 30 000 and 90 000 ft. Large volume, high efficiency filtration devices were employed to acquire samples ranging from 20 000 to 100 000 ambient ft^3 of stratospheric air, and a variety of controls and precautions were incorporated to preclude extraneous, nonstratospheric contamination. Post-impact contamination was a significant source of microorganisms on the filters. Nevertheless, it was possible to determine that the maximum microbial density above the tropopause was less than 1×10^{-3} organisms/ft^3, and was probably less that 1×10^{-4}/ft^3. Molds belonging to the genera *Alternaria* and *Cladosporium* were consistently isolated from samplers exposed in the stratosphere. Author

N65-24000* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ATMOSPHERIC COLLECTION AT 130,000 FEET

Gerald A. Soffen *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 213–219 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

An air impactor, capable of continuous sampling for 12 to 24 hours has been designed to collect particles from the upper atmosphere (130 000 ft). The aerosol is impacted on the previously sterilized surface of a moving drum, driven by a timing mechanism. This enables the sample to be spread over a large surface and to be calibrated with respect to the time of collection. The sample is retrieved, handled aseptically, and cultured using standard laboratory procedures. The instrument has been tested under simulated atmospheric conditions and evaluated. It was flown on three successive balloon flights; a small number of microorganisms was indicated. The results of these collections will be discussed. Author

N65-24039*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SURVIVAL AFTER DECOMPRESSION TO A VACUUM

John Billingham [1964] 19 p refs Presented at Aerospace Med. Assoc., Miami, Fla., 11–14 May 1964

(NASA-TM-X-51669) CFSTI: HC $1.00/MF $0.50

A program to investigate the physiological, pathological, and subsequent behavioral changes in animals exposed for varying periods of time to a near vacuum and recompressed to a 35 000-foot altitude with oxygen was considered essential to provide some indication of the probability of survival, the immediate and residual tissue damage, and the subsequent ability to perform tasks. This paper presents some results of this investigation. Author

N65-24080# Kentucky Univ., Lexington. Dept. of Physiology and Biophysics

RESPONSES OF COLD- AND WARM-ADAPTED DOGS TO INFUSED NORADRENALIN AND ACUTE BODY COOLING Final Report, Oct. 1963–Nov. 1964

Tetsuo Nagasaka and Loren D. Carlson Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Feb. 1965 18 p refs

(Contract AF 41(609)-2193)

(AAL-TR-64-21; AD-462102)

A total of 12 experiments was done in cold-adapted (C-A) and warm-adapted (W-A) beagle dogs, kept more than 40 days at −10° C and 28° C, respectively. The dogs were infused with noradrenalin for 20 minutes at 30° C and after 45 minutes of acute cold exposure to 5° C. At 28° to 30° C, basal O_2 consumption was higher in C-A dogs. Oxygen consumption of C-A dogs increased with a slight increase in the heart rate in the 18 to 20 minutes after body cooling and then decreased. In W-A dogs, O_2 consumption decreased continuously after acute cold exposure. Calorigenic effects of infused noradrenalin were consistent in C-A and W-A dogs at 30° and 5° C; there was no difference between the increased amount of O_2 consumption from the initial levels. Noradrenalin caused increased heart rate in W-A dogs at 30° and 5° C, with decrease or no change in C-A dogs. Colonic, pinna and paw skin temperatures were significantly higher in C-A than in W-A dogs. Noradrenalin caused an increase in the temperatures, but the effect of the drug was more prominent in W-A than in C-A animals at lower temperature. Author

N65-24082# Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska.

PROJECT COLD CASE

Frederick A. Milan Feb. 1965 30 p refs

(AAL-TDR-64-23; AD-462767)

Results of an investigation of the cold land survival capabilities of pilots wearing the full pressure high altitude flying outfit are presented. Six subjects wearing these garments were placed under simulated survival conditions in a wooded area. Ambient air temperatures reached −30° F and were below −27° F for at least 50% of the time. On the third day air temperatures rose and remained at −10° F until the conclusion of the test which lasted 72 hours. Two subjects wearing the full pressure suit without additional clothing survived for 11 and 30 hours. At the end of this time they were fatigued and moderately hypothermic. Two subjects with the full pressure suit plus a nine-piece down-filled survival outfit (clothing outfit, arctic survival) survived for 52 and 72 hours. The 52-hour survivor suffered a noncold injury which necessitated his removal. Two subjects with the full pressure suit plus an experimental ADC walk-around sleeping bag survived for 72 hours each. Author

N65-24083# Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska.

COLD TEST EVALUATION OF SOME COMPONENTS OF THE NASA MERCURY SURVIVAL KIT

Paul A. Albert Feb. 1965 22 p ref

(AAL-TDR-64-24; AD-462624)

Inhouse comparative testing was performed on the NASA and the standard MB-4 one-man life rafts, to determine which provided greater protection against heat loss from subject to

surroundings. Instrumented subjects, with and without air pillow for buttock insulation, were seated in the rafts in water at 2.0° C and ambient air temperatures of 0° and −18° C, for 2-hour periods. The raft and other components, such as the NASA life vest, strobe light, transceiver and water container, were also cold-soaked at −30° C, to determine structural integrity and certain operational characteristics, both during the exposure and after rewarming to a more temperate state. Results indicate that the NASA raft and, under certain conditions, possibly the water container are superior to current Air Force items for survival in cold environments. Author

N65-24227# Joint Publications Research Service, Washington, D. C.
EXPERIMENTAL BIOLOGY AND MEDICINE
Yu. M. Levin et al 10 May 1965 36 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), v. 58, no. 12, Dec. 1964
(JPRS-29980; TT-65-30938) CFSTI: $2.00

CONTENTS:

1. OXYGEN TENSION AND CEREBRAL HEMODYNAMICS DURING FATAL BLOOD LOSS AND SUBSEQUENT RESUSCITATION Yu. M. Levin and B. I. Slovikov p 1–8 refs

2. ON THE INTERACTION OF ANALYZERS DURING ADEQUATE STIMULATION OF THE VESTIBULAR APPARATUS OF A DOG V. N. Barnatskiy p 9–16 refs

3. CELLULAR ACTIVATION DURING THE REPARATIVE REGENERATION OF THE LIVER OF WHITE MICE UNDER CONDITIONS OF FUNCTIONAL ORGANIC STRESS N. F. Semenova p 17–24 refs

4. THE EFFECT OF MEDICINAL SLEEP ON THE MITOTIC ACTIVITY OF NORMAL AND DENERVATED EPIDERMIS OF WHITE RATS A. N. Kulagin p 25–28 refs

5. ON THE POSSIBILITY OF UTILIZING THE NEURONALLY ISOLATED CORTEX FOR INVESTIGATING THE MECHANISM OF THE EFFECT OF PHARMACOLOGICAL AGENTS IN A CHRONIC EXPERIMENT M. M. Khananashvili p 29–33 refs

N65-24228# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology
ECOLOGY OF THE NEVADA TEST SITE. II: STATUS OF INTRODUCED SPECIES
Janice C. Beatley Mar. 1965 39 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-12-554)

A vegetative analysis of three Eurasian plant species, *Bromus rubens*, *Bromus tectorum*, and *Salsola kali*, which are common to the Nevada Test Site area, is presented. Data on the geographic distribution, soil and water requirements, and reproductive patterns of these species are also included. S.C.W.

N65-24230# Joint Publications Research Service, Washington, D. C.
ELECTROPHYSIOLOGY OF CONDITIONED REFLEXES AND DRUG ACTION ON THE BRAIN AND MODELING OF NERVOUS SYSTEM FUNCTIONS
11 May 1965 45 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel'nosti (Moscow), v. 15, no. 1, 1965
(JPRS-30007; TT-65-30955) CFSTI: $2.00

CONTENTS.

1. ELECTROPHYSIOLOGY OF A CONDITIONED REFLEX FORMED IN RESPONSE TO STIMULATION OF THALAMIC MIDLINE NUCLEI G. T. Sakhiulina and G. Kh. Merzhanova p 1–12 refs

2. ELECTROPHYSIOLOGICAL DATA ON THE INFLUENCE OF SOME PSYCHOPHARMACOLOGICAL DRUGS ON VARIOUS STRUCTURES OF THE HUMAN BRAIN N. N. Traugott, L. Ya. Balonov, and D. A. Kaufman p 13–27 refs

3. DYNAMIC LOCALIZATION OF CONDITIONED INHIBITION PRODUCED BY HYPNOTIC SUGGESTION I. I. Korotkin and M. M. Suslova p 28–38 refs

4. SEMINAR ON FUNCTIONS OF THE NERVOUS SYSTEM Ye. N. Sokolov p 39–42

N65-24236# Fish and Wildlife Service, Seattle, Wash. Technological Lab.
EFFECTS OF IONIZING RADIATION ON LIPIDS OF FISH Final Report, Nov. 1963–Nov. 1964
Maurice E. Stansby and George Kudo Washington, D. C., AEC, Nov. 1964 28 p ref
(Contract AT(49-11)-2058)
(TID-21405) CFSTI: $2.00

An investigation was made of problems related to changes caused by irradiation at 0.3 megarad of lipids and associated pigments in eight species of fish ranging in lipid content from 5% to 20%. Samples were irradiated and subsequently stored at 33° F, after being packaged both in evacuated tin cans and in sealed mylar–polyethylene pouches. Changes in the fish, immediately after irradiation and after storage for periods up to 6 weeks, were measured by use of an experienced sensory panel and, in some cases, by determining the peroxide number of the lipid after extraction from the fish. Five species of salmon, rainbow trout, herring, and sablefish were used. All of the species showed a combination of adverse changes that more than neutralized any advantages of retardation of bacterial spoilage by the irradiation process. Samples irradiated and stored in the polyethylene pouches in the presence of air showed extreme adverse changes. Those samples that were vacuum packed showed much less development of rancidity, but loss of normal color and loss of natural flavor was still very marked. Author

N65-24249# Argonne National Lab., Ill.
BIOLOGICAL AND MEDICAL RESEARCH DIVISION ANNUAL REPORT, 1964
Dec. 1964 232 p refs
(Contract W-31-109-ENG-38)
(ANL-6971) CFSTI: $6.00

CONTENTS:

1. BIOCHEMISTRY p 1–28 refs
2. BIOPHYSICS p 29–46 refs
3. CARCINOGENESIS p 47–58 refs
4. CELLULAR FINE STRUCTURE p 59–82 refs
5. ENVIRONMENTAL RADIATION STUDIES p 83–88
6. EPIDEMIOLOGICAL STUDIES IN HUMAN POPULATIONS p 89
7. EXTERNAL RADIATION TOXICITY p 90–119 refs
8. GENETICS p 120–132 refs
9. METABOLISM OF FISSION PRODUCTS p 133–142 refs
10. PHYSIOLOGY p 143–165 refs
11. PLANT RADIOBIOLOGY p 166–205 refs
12. RADIOPROTECTION p 206–214
13. THEORETICAL BIOLOGY p 215–223 refs

N65-24262# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information
RADIOACTIVE DECONTAMINATION A Literature Search
Henry D. Raleigh, comp. Apr. 1965 78 p refs
(TID-3535, Suppl. 1) CFSTI: $3.00

Included are 336 references to unclassified publications on physical and chemical methods for the removal of radioactive contamination. The references cover the period from July 1959 through December 1964. Subject, author, and report number indexes are provided. Author

N65-24272# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology
A DUAL LUNG SCANNING TECHNIQUE FOR EVALUATION OF PULMONARY FUNCTION Preliminary Report
George V. Taplin and Norman D. Poe May 1965 19 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-12-556)

A new scanning technique is described for visualizing the lower respiratory tract safely following the inhalation of radioaerosols. Normally, inhaled radioactive particles of small size (<1.0μ) are evenly distributed throughout the lungs. However, with partial bronchial obstruction, the poorly ventilated region usually shows a lower level of radioactivity with a small area of increased activity at the site of obstruction in man and dog. Complete bronchial obstruction is readily detectable as an area of absent radioactivity. Bronchial patency and arterial blood flow can be evaluated together by scanning following the inhalation of a low-energy aerosol and the intravenous injection of 10μ to 50μ size aggregates of albumin ^{131}I. Combined inhalation and intravenous lung scan studies were performed in patients with tuberculosis, emphysema, and bronchiectasis, and in dogs with experimental and complete bronchial obstruction, pulmonary artery occlusion, and phrenic nerve section. The dual scanning technique provides data on regional pulmonary arterial blood flow and bronchial patency otherwise obtainable only by far more complicated and less physiological methods. Author

N65-24294*# IIT Research Inst., Chicago, Ill.
LIFE IN EXTRATERRESTRIAL ENVIRONMENTS Quarterly Status Report, 15 Feb.–15 May 1965
Charles A. Hagen [1965] 13 p
(Contract NASr-22)
(NASA-CR-62829; IITRI-L6023-1) CFSTI: HC $1.00/MF $0.50

Bacillus cereus and bacillus subtilis vegetative and spore cells grown in a simulated Martian environment were studied to detect and determine possible mutation and adaptation, to determine the effect of freeze–thaw cycles, and to detect changes in thermal resistance. No mutation was observed in either, but freeze–thaw cycles were found to affect spore germination, vegetative cell growth, and sporulation. In neither case was there indicated any change in thermal resistance. C.L.W.

N65-24296*# Dynamic Science Corp., South Pasadena, Calif.
STERILIZATION HANDBOOK Final Report
John B. Opfell, C. E. Miller, N. S. Kovar, P. E. Naton, and R. D. Allen 26 Aug. 1964 185 p refs
(Contract NASw-777)
(NASA-CR-62837; SN-37) CFSTI: HC $5.00/MF $1.25

An effective sterilization and control program handbook is presented containing data on management; design and development of sterile spacecraft, including procured parts, contractor-fabricated parts, materials, and assemblies; and procedures for producing sterility, for measuring microbiological contamination, and for maintaining sterility. It provides the necessary information for the design, manufacture, and verification of biological sterility on and in space vehicles and payloads. R.C.S.

N65-24297*# Dynamic Science Corp., South Pasadena, Calif.
STERILIZATION HANDBOOK, APPENDIX
26 Aug. 1964 82 p
(Contract NASw-777)
(NASA-CR-62838; SN-37, Final) CFSTI: HC $3.00/MF $0.75

The high solubility of ethylene oxide in rubber induced dematitis from ethylene oxide sterilized rubber gloves and garments. In a 10% gaseous atmosphere rubber will absorb from 12 to 15 mg/g of ethylene oxide, but a high diffusivity makes the concentration in rubber gloves safe for most skins 1 hour after sterilization. The physical and chemical properties of the sterilizing agents beta-propiolactone, ethylene imine, ethylene oxide, and formaldehyde are listed in short form. An alphabetical bibliography of articles pertaining to sterilization processes and effects is presented, with reference numbers for the corresponding abstracts in STAR, Barber 1961, Swift 1963, International Aerospace Abstracts, or the DDC Technical Abstracts Bulletin. G.G.

N65-24301# Alaska Univ., College. Geophysical Inst.
PROCEEDINGS, SYMPOSIA ON ARCTIC MEDICINE AND BIOLOGY, IV: FROSTBITE
Eleanor Viereck, ed. 1964 454 p refs Symp. held at the Arctic Aeromed. Lab., Fort Wainwright, Alaska, 17–19 Feb. 1964

CONTENTS:

1. MECHANISM OF FREEZING INJURY IN CLINICAL FROSTBITE H. T. Meryman (Naval Med. Res. Inst.) p 1–11 refs

2. EXPERIMENTAL INJURIES PRODUCED BY PROLONGED EXPOSURE TO COLD AIR J. Peter Kulka (Robert Bent Brigham Hospital) p 13–49 refs

3. STUDIES ON THE PATHOGENESIS OF COLD INJURY. MICROCIRCULATORY CHANGES IN TISSUE INJURED BY FREEZING Eldred D. Mundth (Naval Med. Res. Inst.) p 51–73 refs

4. ATMOSPHERIC COOLING AND THE OCCURRENCE OF FROSTBITE IN EXPOSED SKIN O. V. Wilson (Lund Univ., Sweden) p 73–86 refs

5. PREVENTION OF FROSTBITE AND FREEZING E. E. Hedblom (Naval Air Sta., Whidbey Island) p 87–126

6. FROSTBITE: A METHOD OF MANAGEMENT W. J. Mills, Jr. and Robert Whaley p 127–148 refs

7. CLINICAL ASPECTS OF FROSTBITE INJURY W. J. Mills, Jr. p 149–196

8. PREVENTION AND TREATMENT OF FROSTBITE IN MOUNTAIN WARFARE Francis Ivanichek (Alaska Psychiatric Inst.) p 197–206

9. EXPERIENCES WITH CONSERVATIVE MANAGEMENT OF COLD INJURY AMONG CIVILIANS F. A. Simeone (Western Resorse Med. School) p 207–238 refs

10. POLICY FOR TREATMENT OF FROSTBITE IN NORWAY F. J. Lorentzen (Royal Norwegian AF Inst. of Aviation Med.) p 239–244

11. GENERAL OUTCOOLING AND LOCAL FROSTBITE R. Campbell p 245–256

12. THE EFFECTS OF DRUGS IN THE THERAPY OF FROSTBITE Donald R. Webster (McGill Univ.) p 257–268

13. LOW MOLECULAR WEIGHT DEXTRAN: A NEW AGENT IN THE TREATMENT OF EXPERIMENTAL FROSTBITE Eldred D. Mundth (Naval Med. Res. Inst.) p 269–292 refs

14. SYMPATHECTOMY IN THE TREATMENT OF FROSTBITE Harris B. Shumacker, Jr. (Indiana Univ.) p 293–320 refs

15. THE TREATMENT OF FROSTBITE Joseph Blair (Edgewood Arsenal, Md.) p 321–356

16. GENERAL DISCUSSION p 357–457

N65-24315# Joint Publications Research Service, Washington, D. C.
LEUKEMIA AND IONIZING RADIATION
M. V. Svyatukhin 19 May 1965 14 p refs Transl. into ENGLISH from Arkh. Patol. (Moscow), no. 2, 1965 p 6–13
(JPRS-30161; TT-65-31032) CFSTI: $1.00

The influence of ionizing radiation on the origin and development of human leukemia is discussed. The nature of the threshold radiation dose, the influence of diagnostic and therapeutic X-ray procedures, the medical use of radioactive isotopes as radioactive iodine^{131}, and the diagnostic use of radioactive colloidal thorium oxide, are considered as direct mechanisms which contribute to the development of radiation induced leukemia. Indirect mechanisms of importance to the etiology of radiation induced leukemia as somatic mutations and defective chromosomes, hormones, the thyroid gland, the thymus, and viruses, are also considered. The effects of radiation dose on the development of lymphatic and myeloid leukemias in humans and mice, and inherent problems in the classification of acute lymphatic leukemias appearing after radiation, are also discussed. S.C.W.

N65-24349# Joint Publications Research Service, Washington, D. C.
THE PROBLEM OF PSEUDOPSYCHOPATHOLOGY UNDER CONDITIONS OF ISOLATION AND SENSORY DEPRIVATION
O. N. Kuznetsov and V. I. Lebedev 19 May 1965 14 p refs Transl. into ENGLISH from Zh. Nevropatol. i Psikhiatr. (Moscow), v. 65, no. 3, 1965 p 386–393
(JPRS-30158; TT-65-31029)

An analysis of specific psychic changes, such as illusions, the sensation of a stranger's presence, subjectively realized dreams, eudetic conceptions, ideas of reference, and overvalued ideas, which were observed in experiments on prolonged isolation with relative sensory deprivation, is presented. It is surmised that although these psychic manifestations resemble psychopathological disturbances, they show fundamental differences. The established psychic changes are attributed to specific individual reactions to the experimental conditions. The term pseudopsychopathology is coined to distinguish these specific reactions from pathological reactions. The use of pseudopsychopathological manifestations in general psychiatry, for differentiating between psychopathological symptoms caused by disease and reactions to disturbances induced by the outside world, is discussed. S.C.W.

N65-24351# Joint Publications Research Service, Washington, D. C.
CONTROL SYSTEMS AND MAN'S HEALTH
A. V. Napalkov and N. A. Chichvarina 24 May 1965 18 p Transl. into ENGLISH from Priroda (Moscow), no. 12, Dec. 1964 p 31–38
(JPRS-30214; TT-65-31063) CFSTI: $1.00

A discussion of control mechanisms which induce pathological conditions in living organisms is presented. It is surmised that at the basis of the theory of self-organizing control systems lie algorithms of different levels, which influence the functioning of the internal organs. The integration of algorithms into cybernetics for determining the etiology and pathology of certain disease entities is discussed. The significance of complex control mechanisms in cancer, hypertension, angina pectoris, bronchial asthma, and diabetes is exemplified. Also included is an analysis of Pavlovian theory. Results of experiments supporting the theory that the formation of new pathological forms of control lie at the basis of many diseases are reported. S.C.W.

N65-24362# California Univ., Berkeley. Operations Research Center
AN INVESTIGATION OF THE BURN-IN AND RELATED PROBLEMS
Michael J. Lawrence Nov. 1964 31 p refs
(Contract Nonr-3656(18))
(ORC-64-32(RR); AD-613276)

Two problems involving the derivation of bounds on distributions with a decreasing failure rate (DFR distributions) are presented. Given that an item has a decreasing failure rate, sharp upper and lower bounds on the burn-in time to achieve a specified mean residual life are derived. The bounds rely only on the DFR assumption, and a knowledge of the first moment and a percentile of the failure distribution. An early estimate of the 5-year survival proportion (commonly called the 5-year cure rate) is of interest in assessing the value of a treatment for a mortal disease such as cancer. Assuming that the distribution of time to death is DFR and assuming a knowledge of the mean and a percentile, sharp upper and lower bounds on the survival proportion are obtained. In addition, some bounds on the hazard rate and density of a DFR distribution are given. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering, crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N65-23710*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CORIOLIS EFFECTS DURING PITCH AND ROLL MANEUVERS IN A PILOTED FLIGHT SIMULATOR
John D. Stewart and Brant Clark (San Jose State Coll.) [1964] 31 p refs Presented at the Ann. Meeting of Aerospace Med. Assoc., Miami Beach, 11–14 May 1964
(NASA-TM-X-51755) CFSTI: HC $2.00/MF $0.50

The effects of a suprathreshold values of Coriolis acceleration on flight simulator pilots' perception of illusory motion, and perception of position in space were studied in order to obtain data on perception of cockpit rotation, detection of changes in cockpit position, and on motion sickness. Results of the study suggest that, within the range of conditions studied, the subjects judge body position with respect to direction of resultant force acting on the body. The data also support the belief that stimulation of the semicircular canal by Coriolis forces has little effect on judgement of the postural vertical. C.L.W.

N65-23850# Royal Inst. of Tech., Stockholm (Sweden). Speech Transmission Lab.
SPEECH TRANSMISSION LABORATORY QUARTERLY PROGRESS AND STATUS REPORT, OCTOBER–DECEMBER 1964
J. Lindqvist et al 15 Jan. 1965 55 p refs
(Contract DA-91-591-EUC-3413; Grants AF-EOAR-64-28; NIH NB-04003-02)
(STL-QPSR-4/1964)

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SPEECH PRODUCTION
1. INVERSE FILTERING. INSTRUMENTATION AND TECHNIQUES J. Lindqvist p 1–4 refs
2. THE NASAL CAVITY STRUCTURES G. Bjuggren and G. Fant p 5–7 refs

SPEECH ANALYSIS
3. ACOUSTIC ANALYSIS OF HUNGARIAN VOWELS T. Tarnoczy p 8–12 refs
4. SOME REMARKS ON THE AVERAGE SPEECH SPECTRUM T. Tarnoczy and G. Fant p 13–14 refs

AIDS FOR THE DEAF
5. RECODING SPEECH FOR THE DEAF AND HARD OF HEARING. A STATUS REPORT A. Risberg p 15–20 refs
6. A BIBLIOGRAPHY ON RECODING OF SPEECH FOR THE DEAF AND HARD OF HEARING A. Risberg p 21

N65-23960# Martin Co., Baltimore, Md.
PERSONNEL SUB SYSTEMS
D. G. Thomas [1964] 23 p refs Presented at Eurospace Conf., Brussels, 23–24 Jan. 1964

The use of this analytical basis for the determination of the allocation of functions to man and machine forms the cornerstone of the concept referred to as Systems Functional Analysis. This analysis begins with a definition of the proposed mission and describes in detail the functions essential to the fulfillment of the mission requirements. The initial step is the description in general of the gross functions of the system. Progressively, these gross functions are further defined into subfunctions, and sub-subfunctions. Allocation of these functions, severally, to man or machine, respectively to their relative capability, reliability, economy, etc., can then be performed. The techniques for accomplishing this objective, which constitute a methodology for human engineering support of system design, can be approached by generating an appropriate checklist and precisely articulating a task sequence analysis, in terms of logic symbols. Author

N65-23985* Litton Systems, Inc., St. Paul, Minn. Applied Science Div.
MECHANICAL METHODS FOR COLLECTING STRATOSPHERIC BIOLOGICAL AEROSOLS
D. A. Lundgren, A. R. McFarland, and V. W. Greene *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 49–67 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Characteristics of impaction and filtration aerosol collection mechanisms are reviewed with particular reference to high altitude environments. Both theoretical and experimental aspects are considered. Discussions and data are presented relative to collection efficiency, viability decay, and amenability of sample to subsequent analysis. Examples of current stratospheric particulate sampling apparatus are given, and their applicability to biological aerosol sampling is examined. It was concluded that very high collection efficiencies on particles of microbiological size are more easily obtained as stratospheric pressure decreases (altitude increases). Impaction and filtration methods are most applicable to stratospheric biological aerosol collection requirements of large sample size and low background contamination levels. Rockets, aircraft, and balloonborne sampling apparatus now exist that could be applied to biological sampling with certain limitations placed upon each. The most serious problem of high velocity aircraft and rocket sampling for viable biological matter is heating the collected particles. Aircraft and balloonborne samplers are most easily adapted to biological sampling requirements. Author

N65-24004# California Univ., Los Angeles. Biotechnology Lab.
UPPER EXTREMITY PROSTHETICS RESEARCH; HUMAN TRACKING; SENSORY MOTOR CONTROL; AND MYOELECTRIC CONTROL
John Lyman 15 Mar. 1965 24 p
(Contracts V1005p-9779; N123(60530)32857A; AF 33(615)-1969; Grant VRA-RD-1201M-64)
(Rept.-65-14; AD-613680)

The objectives and current status of biotechnological projects on prosthetics, sensory motor control, human engineering, and myoelectric control systems are reported. Among the specific topics discussed was the selection of an amputee who indicated willingness to undergo minor surgery for correction of a muscle hernia. Strain-gage measurements were made of the following muscles on the amputated site: pectoralis, latissimus dorsi, upper and lower part of the trapezius, and the sacrospinalis. All of these muscles were highly atropied and only the pectoralis provided a useful control signal. Output on the nonamputated side was comparable to nonamputee subjects. E.E.B.

N65-24064# Joint Publications Research Service, Washington, D. C.
BIOLOGICAL MODELING AND BIONICS
P. I. Gulyayev 20 May 1965 9 p refs Transl. into ENGLISH from Vestn. Vysshey Shkoly (Moscow), no. 2, Feb. 1965 p 41–47
(JPRS-30177; TT-65-31041) CFSTI: $1.00

The merging of scientific disciplines, such as mathematics, bionics, and cybernetics for the development of models to solve complex biological problems, is discussed. S.C.W.

N65-24065# Joint Publications Research Service, Washington, D. C.
ELECTROMETRY IN MEDICINE
20 May 1965 5 p Transl. into ENGLISH from Nauka i Tekhn. (Riga), no. 12, Dec. 1964 p 37
(JPRS-30182; TT-65-31045) CFSTI: $1.00

The development of new methods for use in clinical and diagnostic medicine is reported. A method for measuring stomach acidity without removing gastric juice is based on the use of an electronic apparatus that automatically records the movements, acidity, and temperature of the stomach. An instrument for determining the condition of the adrenal cortex in cardiovascular and metabolic disorders, and a fluorometric method for determining hormone concentration to an accuracy of one ten-millionth of a gram are reported. S.C.W.

N65-24231# Joint Publications Research Service, Washington, D. C.
ONE APPROACH TO MODELING PSYCHOLOGICAL FUNCTIONS
N. M. Amosov, E. T. Golovan', S. Ya. Zaslavskiy, K. A. Ivanov-Muromskiy, and V. S. Starinets 19 May 1965 38 p refs Transl. into ENGLISH from Kibernetika i Tekhn. Vychisleniy (Kiev), 1964 p 116–143

In an investigation of the simulation of the human psychological activity, attention is directed toward a proposed model of the mental process, which has, as its basis, logic rules specifically developed in the learning process, and which requires

the presence of emotional states for controlling and monitoring. These emotional states control and direct the mental process and are altered, further developed, or stabilized in response to the resulting intellectual activity. From the technical point of view, a general discussion is given of the model operation, along with a block diagram and a discussion of the operation of the individual blocks of the model. C.L.W.

N65-24254# North American Aviation, Inc., Columbus, Ohio.
EFFECTS OF TASK LOADING ON PILOT PERFORMANCE DURING SIMULATED LOW-ALTITUDE HIGH-SPEED FLIGHT
Stanley M. Soliday et al Ft. Eustis, Va., Army Transportation Res. Command, Feb. 1965 92 p refs
(Contract DA-44-177-AMC-66(T))
(USATRECOM-TR-64-69; AD-614243)

The effects of task loading on pilot performance during simulated low-altitude high-speed flight were studied. Approximately 210 hours of flight were made by experienced pilots in a moving-base simulator that had a total vertical travel of 12 feet and an acceleration capability of ±6G. The flights were made over several types of terrain at several airspeeds under different conditions of navigation task and emergency task loading. Medium-heavy turbulence was simulated for all flights. Data were analyzed in terms of human performance aspects of the missions. Author

N65-24348# Joint Publications Research Service, Washington, D. C.
PROBLEMS OF SPACE FLIGHT
L. Khachatur'yants 19 May 1965 7 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), 20 Mar. 1965 p 6
(JPRS-30152; TT-65-31023) CFSTI: $1.00

Technical and biological problems associated with extravehicular activity in free space are discussed. Emphasized is the effect of weightlessness on coordinated movements. The inability of pressure suits to guarantee freedom of movement and an adequate field of vision is discussed. Research focusing on the technological development of single- and two-seater capsules with outside manipulators for overcoming problems of depth perception and motor coordination; and the development of a test bed which would simulate supportless space and train cosmonauts to orient themselves purposefully, with the ultimate goal being to walk as well as turn in space is proposed. S.C.W.

N65-24360# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Behaviorial Sciences Lab.
A COMPARISON OF THREE FULL-PRESSURE SUITS IN TERMS OF CONTROL ACTIVATION TIME Final Report, Nov. 1963–Feb. 1964
Earl D. Sharp Dec. 1964 22 p
(AMRL-TR-64-126; AD-613597)

Three pressure suits, both pressurized and unpressurized, were compared on the basis of times taken by two subjects to initiate action and to reach to and operate controls located in various positions in a simulated workspace. The suits compared were the Apollo Phase B, the Gemini G2C-1, and the Apollo 1960 State-of-the-Art. The controls used were knobs, toggle switches, and pushbuttons. The work area investigated was semicircular, extending left and right 78°, 34 to 49 inches above the floor, at a distance of approximately 2 feet. Average times for each combination of suit, suit condition (pressurized or unpressurized), control type, control location, and hand used are presented. No suit appeared to be unequivocally superior. Total time to initiate action, and to reach to and operate toggle switches and pushbuttons was typically, although not universally, shorter when wearing the Apollo 1960 State-of-the-Art suit. Total time to initiate action and to reach to and operate knobs was typically, although not universally, shorter when wearing the Gemini G2C-1 suit; however, not all locations could be reached when wearing this suit. Author

N65-24370*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEMS OF ENGINEERING PSYCHOLOGY
B. F. Lomov, ed. May 1965 153 p Transl. into ENGLISH of "Probl. Inzh. Psikhologii" Presented at the 1st Leningrad Conf. on Eng. Psychology, Jun. 1964
(NASA-TT-F-312) CFSTI: HC $5.00/MF $1.00

An annotated bibliography of 120 papers on problems in engineering psychology is presented. Information abstracts cover research on self-organizing systems, functions of humans in control systems, characteristics of operator activities, simulation of psychic activity, reliability and accuracy of operator activities, design of operator working posts, training and selection of operators, group activity, methods of investigating human activity, reception of information by human subjects, sensorimotor processes, reactions, operative thinking, and memory. J.M.D.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N65-23365 Joint Publications Research Service, Washington, D. C.
THE VAPOR PRESSURE OF A MELT $SnCl_2$–KCl
Jui-wu P'eng and Tzu-yao Ch'en *In its* Transl. on Communist China's Sci. and Tech. 29 Apr. 1965 p 16–21 refs (See N65-23363 13-34) CFSTI: $3.00

The vapor pressure of $SnCl_2$–KCl melt was determined using a flow method for calculating the vapor pressure of $SnCl_2$ and $SnCl_2$–KCl under 360° to 425° C. Experimental values and related thermodynamic functions are presented. The activity of $SnCl_2$ in a $SnCl_2$–KCl melt was also determined by concentration of electric cells. Observing electrical potential values, it was found that when $N_{SnCl_2} = 1$ and concentration is zero, the diffusion electrical potential is 0.08 volts. Using improved measurement techniques, it was shown that at 380° C, the $SnCl_2$–KCl activity in a $SnCl_2$–KCl melt could agree with the value of the vapor pressure calculation assuming the vapor is monomers. It is surmised that a melt equilibrium vapor consists principally of monomers. S.C.W.

N65-23367 Joint Publications Research Service, Washington, D. C.
MICRO-QUANTITATIVE DETERMINATION OF CADMIUM AND LEAD BY THE VOLTAGE AND AMPERE METHOD OF MERCURY ANODE
Wang-shu, Shu-yun Chang, Kuo-li, and Ch'eng-p'u *In its* Transl. on Communist China's Sci. and Tech. 29 Apr. 1965 p 54–57 refs (See N65-23363 13-34) CFSTI: $3.00

This paper presents the method of voltage and ampere from the anode as a substitute for the Bush oscilloscope

method to determine microquantities of cadmium and lead in pure selenium. Beryllium sulfate is used as an electrolytic agent as a substitute for beryllium chloride. This is better than the ordinary spectrum method and it increases the sensitivity of the determination. Author

N65-23469# Joint Publications Research Service, Washington, D. C.

DETERMINATION STUDIES OF COMMON PLATINUM AND RARE-EARTH METALS

23 Apr. 1965 43 p refs Transl. into ENGLISH from Zh. Analit. Khim. (Moscow), v. 20, no. 2, 1965 p 153–164, 183–191, 196–199

(JPRS-29732; TT-65-30806) CFSTI: $2.00

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2. SPECTROPHOTOMETRIC STUDY OF THE REACTIONS OF YTTRIUM, LANTHANUM, AND CERIUM WITH METHYLTHYMOL BLUE L. S. Serdyuk and V. S. Smirnaya p 14–19 refs (See N65-23471 13-06)

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5. COULOMETRIC TITRATION OF IRIDIUM(IV) WITH ELECTROGENERATED COPPER(I) IN THE PRESENCE OF RHODIUM(III) N. I. Stenina and P. K. Agasyan p 35–41 refs (See N65-23474 13-06)

N65-23470 Joint Publications Research Service, Washington, D. C.

AMALGAM POLAROGRAPHY WITH ACCUMULATION. POLAROGRAPHIC BEHAVIOR OF GERMANIUM

O. S. Stepanova, M. S. Zakharov, and L. F. Trushina *In its* Determination Studies of Common Platinum and Rare-Earth Metals 23 Apr. 1965 p 1–13 refs (See N65-23469 13-06) CFSTI: $2.00

The accumulation type of amalgam polarography method has been to study anodic spikes of germanium against a background of 0.2 M Na_2CO_3 + 0.025 M complexion III. The trough of the anodic germanium peak has been studied as a function of solution pH, accumulation potential, germanium ion concentration in solution, and the effect of interfering impurities of certain elements. Several physicochemical characteristics of the anodic spike of germanium have been calculated. Author

N65-23471 Joint Publications Research Service, Washington, D. C.

SPECTROPHOTOMETRIC STUDY OF THE REACTIONS OF YTTRIUM, LANTHANUM, AND CERIUM WITH METHYLTHYMOL BLUE

L. S. Serdyuk and V. S. Smirnaya *In its* Determination Studies of Common Platinum and Rare-Earth Metals 23 Apr. 1965 p 14–19 refs (See N65-23469 13-06) CFSTI: $2.00

It was established that yttrium, lanthanum, and cerium form with methylthymol blue complexes with absorption maxima at a wavelength of 600 millimicrons. The isomolar series method was used to establish that the methyl-dye ratio in these complexes is 1:1, their instability constants equal $(1.2 \pm 0.1) \cdot 10^{-7}$, $(8.1 \pm 0.9) \cdot 10^{-7}$, and $(7.0 \pm 0.4) \cdot 10^{-7}$, respectively. It was shown that at pH 6.5 the highest difference in optical density of reagent and complex solutions is observed. The possibility of photometric determination of yttrium, lanthanum, and cerium, with methylthymol blue was established at this pH value. Author

N65-23472 Joint Publications Research Service, Washington, D. C.

DETERMINATION OF ULTRASMALL QUANTITIES OF BISMUTH AND ANTIMONY IN GERMANIUM AND GERMANIUM TETRACHLORIDE BY THE METHOD OF ANODE VOLT-AMPEROMETRY ON A STATIONARY MERCURY ELECTRODE

Ye. N. Vinogradova and A. I. Kamenev *In its* Determination Studies of Common Platinum and Rare-Earth Metals 23 Apr. 1965 p 20–26 refs (See N65-23469 13-06) CFSTI: $2.00

The accumulation-type amalgam polarography method was used in determining impurities of bismuth and antimony in metallic germanium and germanium tetrachloride. Upon weighing samples of 0.75 gram up to $1.3 \cdot 10^{-7}$ % bismuth and up to $2 \cdot 10^{-7}$ % antimony can be detected. Errors of determination amounted to 10% to 25%. Author

N65-23473 Joint Publications Research Service, Washington, D. C.

A POLAROGRAPHIC METHOD FOR DETERMINATION OF NICKEL IN PHOSPHOR MATERIALS

Ye. I. Lenisov and L. S. Nadezhina *In its* Determination Studies of Common Platinum and Rare-Earth Metals 23 Apr. 1965 p 27–34 refs (See N65-23469 13-06) CFSTI: $2.00

Conditions have been stated for ion exchange enrichments of impurities and analysis of the ZnS and ZdS phosphors on strongly basic anion exchange resin, permitting a 60 000-volt increase in the trace impurity content. It has been shown that in the determination of very small amounts of nickel, iron always accompanying it cannot be quantitatively precipitated by pyridine, which impedes polarographic determination of nickel on a pyridine-chloride background. Mannite is suggested as an additive, strongly shifting the half-wave potential of iron. A method of nickel determination in metallic zinc, cadmium, and the phophors zinc sulfide and cadmium zinc has been developed. Author

N65-23474 Joint Publications Research Service, Washington, D. C.

COULOMETRIC TITRATION OF IRIDIUM(IV) WITH ELECTROGENERATED COPPER(I) IN THE PRESENCE OF RHODIUM(III)

N. I. Stenina and P. K. Agasyan *In its* Determination Studies of Common Platinum and Rare-Earth Metals 23 Apr. 1965 p 35–41 refs (See N65-23469 13-06) CFSTI: $2.00

A simple and rapid method of coulometric determination of relatively small amounts of Ir(IV) in the presence of certain amounts of Rh(III) by electrogenerated Cu(I) from a $CuSO_4$ solution in 4 M hydrochloric acid has been developed with a potentiometric indication of titration end point. The sensitivity of the method is ~ 10^{-5} M (~ 2 micrograms/ml). Author

N65-23479 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTERACTION IN THE SYSTEM Na_2O–Al_2O_3–SiO_2–CaO–H_2O AS A FUNCTION OF ALUMINATE SOLUTION CONCENTRATIONS

L. P. Ni, L. V. Bunchuk, and V. D. Ponomarev *In its* Nonferrous Met. 7 Aug. 1964 p 79–85 refs (See N65-23478 13-17)

A study was carried out on interaction in the system Na_2O–Al_2O_3–SiO_2–CaO–H_2O for a wide range of sodium oxide concentrations (100 to 500 g/l) with reference to the hydrochemical method of alumosilicate decomposition. Thermographic and crystallo-optical descriptions of the solid phases formed in the system were obtained. Depending on the solution concentrations it is necessary to distinguish a region of stable presence of sodium–calcium hydrosilicate and the range of stable presence of sodium alumosilicate and calcium metasilicate. The first region takes in the range of concentrations of sodium oxide from 200 to 500 g/l, the second, below 200 g/l. The microstructure of the sodium–calcium hydrosilicate precipitating in the first region depends on the solution concentration. The chemism of the processes occurring in the system for the two established regions was determined. Author

N65-23480 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DESILICIFICATION OF HIGH-MODULUS ALUMINATE SOLUTIONS

A. I. Mokryshev and V. D. Ponomarev *In its* Nonferrous Met. 7 Aug. 1964 p 86–94 refs (See N65-23478 13-17)

A study was made of the effect of concentration on the process of desilicification of synthetic high-modulus solutions. It was found that the desilicification takes place more fully with decreasing alkali concentration. It was established that maximum desilicification is attained at 120° for solutions with a concentration of 250 g/l Na_2O, and at 200° for stronger solutions. The effect of priming on the desilicification process was studied. It was found that the presence of primer up to 60 g/l makes the process more thorough, while further increases in the amount of primer do not improve the process. Triple use of primer likewise did not affect the thoroughness of desilicification. It was found that the process of desilicification of both synthetic and industrial solutions comes to almost a complete end after 12 hours. Author

N65-23481 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A STUDY OF ALUMINA SURFACE TEMPERATURE IN INDUSTRIAL ALUMINUM BATHS BY THE STATISTICAL METHOD

A. A. Vol'berg and A. I. Belyayev *In its* Nonferrous Met. 7 Aug. 1964 p 95–102 refs (See N65-23478 13-17)

The basic reason for temperature dispersion of the upper alumina layer in the bath crust is its nonuniformity in thickness. Between the temperature of the upper alumina layer and the layer thickness there is a close correlation. The various baths whose working parameters lie within certain limits have a practically equal average temperature of the alumina surface. The overall dispersion of the upper alumina layer temperature consists 70.7% of the dispersion of measurements along the bath semiperimeter, and only 7.7% by the dispersion of measurements over the horizons; consequently, the measurements can be confined to a single horizon. To lower the temperature dispersion, it is necessary to choose a horizon with the least fluctuations of the alumina layer thickness. The total number of alumina temperature measurements in a single bath or group of baths is determined by the assumed value of the error. Author

N65-23482 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ELECTROCHEMICAL BEHAVIOR OF OXIDE-CARBON ANODES OF TiO_2 + C IN CHLORIDE MELT

Gu-Sin Fan and A. I. Belyayev *In its* Nonferrous Met. 7 Aug. 1964 p 103–110 refs (See N65-23478 13-17)

With a carbon content of 150 mole in an anode made of TiO_2 + C with an anode current density of 0.1 a/cm^2, a maximum anode yield with respect to current was obtained. With a current density of 0.05 to 0.26 a/cm^2, titanium passes from the oxide–carbon anode into the electrolyte mainly in the form of tetravalent ions; the proportion of tetravalent titanium ions increases with current density. On the basis of the resulting polarization curves, a mechanism of the solution of the oxide–carbon anode made of TiO_2 + C in electrolysis is suggested. Author

N65-23483 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HEATS OF FORMATION OF CUBICAL VANADIUM CARBIDES

N. M. Volkova and P. V. Gel'd *In its* Nonferrous Met. 7 Aug. 1964 p 111–118 refs (See N65-23478 13-17)

By the method of burnup of calciethermal vanadium the heat of formation is established of its pentoxide from elements as equal to 778.0 ±2.0 kj/g-atom V. The heat of formation of cubical vanadium carbides depends little on composition and is approximately equal to 102.5 ±7.6 kj/g-atom V or 127.0 ±9.8 kj/g-atom C. The heats of formation of vanadium oxycarbides depend on their content of oxygen, and increase with the concentration of the latter. Author

N65-23484 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DECOMPOSITION POTENTIALS OF ALKALI METAL AND SILVER NITRATE MELTS

P. I. Protsenko and A. V. Protsenko *In its* Nonferrous Met. 7 Aug. 1964 p 119–124 refs (See N65-23478 13-17)

Decomposition potentials of alkali metal and silver nitrates over a wide range of temperatures were determined by taking polarization curves and using a porous glass diaphragm. The decomposition potentials of molten nitrates vary strictly linearly as a function of temperature. An approximate scheme for the mechanism involved in the electrolysis of nitrates and secondary processes at the electrodes is proposed. Author

N65-23485 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTERACTION OF NIOBIUM AND TANTALUM PENTOXIDES WITH SOLUTIONS OF CAUSTIC POTASH AT TEMPERATURES OVER 100°

M. A. Orekhov and A. N. Zelikman *In its* Nonferrous Met. 7 Aug. 1964 p 125–136 refs (See N65-23478 13-17)

Interaction of calcinated niobium and tantalum pentoxides and their mixtures with KOH solutions of various concentrations in the 130° to 200° temperature interval was studied. Depending on concentration, temperature, and duration of treatment with KOH solutions in an autoclave, niobium pentoxides interact with the formation either of soluble potassium hexaniobate $K_8Nb_6O_{19}$·aq, or of insoluble potassium metaniobate $KNbO_3$. At 200°, 1:s = 1:20, and base concentration below 33% (7.75N), the potassium hexaniobate is stable; at higher KOH concentrations, the hexasalt is converted into the metasalt. Tantalum pentoxide at caustic potash concentrations between 4.5 and 11.2 N and temperatures of 150° and 200° forms only anhydrous metatantalate $KTaO_3$. The mixture of niobium and tantalum pentoxides interacts with KOH solutions with the formation either of soluble niobo–tantalate salts, or of anhydrous metasalts. This is not accompanied by a selective entry of the niobium into solution. The solubility of

potassium hexaniobate and pentatantalate and their mixtures at 90° in solutions of caustic potash of various concentrations was studied. Author

N65-23486 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRODUCTION OF 99.9999%-PURE GALLIUM BY THE METHOD OF FRACTIONAL CRYSTALLIZATION AND ZONAL MELTING

E. Papp and K. Soymar *In its* Nonferrous Met. 7 Aug. 1964 p 137-147 refs (See N65-23478 13-17)

Methods of obtaining gallium of 99.9999% purity by electrolytic refining, fractional crystallization, and zonal melting are described. It was found that in the case of an impurity content of 0.0001% to 0.0003%, practically all impurities are concentrated in the liquid gallium. Fractional crystallization is applicable for obtaining 99.9999% pure gallium and concentrating impurities. Oxide film on gallium was found strongly enriched with impurities. This phenomenon may be used for the purification of gallium; it also explains contradictions in published data on the distribution of individual impurities in gallium. Equipment for zonal melting using a rotating drum is described and results of this type of gallium refined to 99.999% and 99.9999% purity in the indicated way are presented. Data on changes in the impurities content of 99.9999% pure gallium in individual stages of production are also included. To obtain gallium of 99.9999% purity, it is possible to employ electrolytic refining, fractional crystallization, or zonal melting. Author

N65-23558# Argonne National Lab., Ill. Chemistry Div.

NITRIC ACID-ORGANIC SOLVENT MIXTURES FOR SEPARATION OF PLUS-THREE ACTINIDES ON ANION RESINS. I: SURVEY OF SOLVENTS

D. C. Stewart, C. A. A. Bloomquist, and J. P. Faris Feb. 1965 23 p refs

(Contract W-31-109-ENG-38)

(ANL-6999) CFSTI: $1.00

More than 60 water-miscible organic solvents were surveyed for use as possible components in mixed solvent-nitric acid elutriants to accomplish transplutonium element separations in anion-exchange resin systems. Several solvents for accomplishing such separations were found, nine of which met preliminary criteria established to determine their suitability for hot-cell use with high levels of radiation. Americium-curium separation factors superior to those of previously reported systems were found in a number of the solvent mixtures. Several solvents were also discovered having promising potentiality for the difficult americium-promethium separation. Author

N65-23602# Iowa State Univ. of Science and Technology, Ames Lab.

THE NITROGEN ISOTOPIC SEPARATION FACTORS OF VARIOUS ORGANIC AMINES ON AMBERLITE IR-120 CATION EXCHANGE RESIN

Duane D. Nowlin and Jack E. Powell Nov. 1964 91 p refs

(Contract W-7405-ENG-82)

(IS-1059) CFSTI: $4.00

Ion-exchange displacement chromatography was used to measure the nitrogen isotopic separation factors of 10 organic amines and ammonium hydroxide. A column of Amberlite IR-120 H^+-form resin was used, and the aqueous amine solutions were approximately 0.125N. The separation factors of the compounds investigated are ammonium hydroxide, 1.0254; methylamine, 1.0223; ethylamine, 1.0218; n-propylamine, 1.0199; iso-propylamine, 1.0197; n-butylamine, 1.0183; dimethylamine, 1.0174; diethylamine, 1.0172; dipropylamine, 1.0159; trimethylamine, 1.0130; and triethylamine, 1.0117. According to the theory presented the isotopic separation factor reported for most compounds is a result of three independent isotopic equilibrium reactions. However, for the amines studied only one of these reactions contributes significantly to the measured separation factor. This is the isotopic equilibrium occurring in the solution phase between amine ions and undissociated amine molecules. This theory is used to explain the separation factors reported in this work and also the concentration and temperature dependence of α. Author

N65-23679*# National Aeronautics and Space Administration, Washington, D. C.

CONTINUOUS ANALYSIS IN CHEMICAL PROCESS PLANTS [KAGAKU KOJO NI OKERU RENZOKU BUNSEKI]

Hidefumi Konishi May 1965 17 p Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 67, no. 11, 1964 p 1710-1713

(NASA-TT-F-9342) CFSTI: HC $1.00/MF $0.50

Continuous analyzers for industrial chemical operations are reviewed and systematized. Some of the general considerations pertaining to analyzers, including the problems of coordinating them with other industrial chemical instruments and automation, are discussed. It is stressed that more knowledge of physical measurement principles than chemical processes is required, but synthesis of both is essential. Guidelines for deciding on the most suitable method of measurement and analysis, instrumentation, maintenance procedure are presented, and various aspects of sampling the chemical product for analysis are discussed. Author

N65-23680*# National Aeronautics and Space Administration, Washington, D. C.

THE INTERACTION OF MAGNESIUM OXIDE AND ZIRCONIUM DIOXIDE WITH REFRACTORY COMPOUNDS AT HIGH TEMPERATURES IN VACUO [VZAIMODEYSTVIYE OKISI MAGNIYA I DVUOKISI TSIRKONIYA S TUGOPLAVKIMI SOYEDINENIYAMI PRI VYSOKIKH TEMPERATURAKH V VAKUUME]

G. V. Samsonov, A. L. Burykina, L. V. Strashinskaya, and E. A. Pugach Apr. 1965 19 p refs Transl. into ENGLISH from Met. i Gorn. Delo (USSR), no. 4, 1964 p 106-115

(NASA-TT-F-9346) CFSTI: HC $1.00/MF $0.50

Reactions between zirconium dioxide and magnesium oxide with metal-like carbides, nitrides, and borides in vacuo at 1800° to 2200° C, and phases formed therein, are discussed. It is found that carbides are most stable and borides least stable in combination. Author

N65-23682*# National Aeronautics and Space Administration, Washington, D. C.

INTERACTION OF CERTAIN REFRACTORY CARBIDES WITH ZIRCONIUM DIOXIDE [O VZAIMODEYSTVII NEKOTORYKH TUGOPLAVKIKH KARBIDOV S DVUOKIS'YU TSIRKONIYA]

A. I. Avgustinik, V. M. Gropyanov, G. V. Drozdetskaya, and V. Sh. Vigdergauz Apr. 1965 14 p refs Transl. into ENGLISH from Ogneupory (Moscow), no. 12, 1964 p 570-575

(NASA-TT-F-9349) CFSTI: HC $1.00/MF $0.50

The high-temperature interaction of ZrC and ZrO_2 mixtures is studied; they are found to be most stable at these

temperatures, with cermets less stable. Lattice parameters of both are discussed. The properties of the cermets indicate usefulness as structural materials. Author

N65-23683*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF THE CHEMICAL COMPOSITION OF ZIRCONIUM AND NIOBIUM CARBIDES IN THE HOMOGENEITY REGION ON THEIR ELECTRIC AND THERMAL PROPERTIES [VLIYANIYE KHIMICHESKOGO SOSTAVA NA ELECTRO- I TEPLOFIZICHESKIYE SVOYSTVA KARBIDOV TSIRKONIYA I NIOBIYA V OBLASTI IKH GOMOGENNOSTI]

V. S. Neshpor, S. S. Ordan'yan, A. I. Avgustinik, and M. B. Khusidman Apr. 1965 16 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 37, no. 11, 1964 p 2375–2382

(NASA-TT-F-9350) CFSTI: HC $1.00/MF $0.50

The electrical and thermal properties of the IV and V group monocarbides are investigated, and differences between carbides associated with the electron collective state, resulting from differences in effective valences of transition metals, are found. Properties of these carbides show similarities in lattice dynamics. Author

N65-23724# International Union of Crystallography. Commission on Crystallographic Apparatus

LOW-TEMPERATURE X-RAY DIFFRACTION Bibliography 2

Ben Post (Polytechnic Inst. of Brooklyn) 1964 89 p

An annotated bibliography containing earlier and current literature on low-temperature X-ray diffraction techniques is presented. Emphasis has been placed on recent literature and the study of low melting crystalline solids. Among the apparatus included are an X-ray camera for powder diagrams at any temperature, a liquid helium cryostat for X-ray diffraction studies, a low-temperature apparatus for single crystal X-ray goniometers, and a method of stabilizing the specimen temperature for single crystal X-ray crystallography. Among the crystal structure investigations cited are an X-ray investigation of potassium phosphate at low temperature, X-ray studies on cetyl alcohols, the low temperature modification of N-propylammonium, and the thermal expansion of solid bromine. S.C.W.

N65-23725# Oak Ridge National Lab., Tenn. Reactor Chemistry Div.

RARE-EARTH HALIDES

R. E. Thoma May 1965 63 p refs

(Contract W-7405-ENG-26)

(ORNL-3804) CFSTI: $3.00

A review is presented of the chemistry of the anhydrous rare-earth halides. Topical emphasis is placed on the current state of chemical development in this field, preparation and purification methods, properties of the simple halides, the oxyfluorides, rare-earth metal–trihalide systems, complex halides, phase diagrams, and absorption spectra. Tabular data are included which summarize the currently available data on physical properties, oxidation potentials, crystallographic properties, and phase equilibria. Author

N65-23732# Societa Ricerche Impianti Nucleari, Saluggia (Italy).

CONTROL OF THE PURIFICATION PROCESS OF ALUMINUM BY FUSION, WITH THE HELP OF RESISTOMETRIC ANALYSIS AND BY NEUTRON ACTIVATION [CONTROLLO MEDIANTE ANALISI RESISTOMETRICA E PER ATTIVAZIONE NEUTRONICA DI UN PROCESSO DI PURIFICAZIONE PER ZONA FUSA DI ALLUMINIO]

D. Gelli (Ist. Sper. Metalli Leggeri) R. Malvano, and N. Sacchetti (Genoa Univ.) 1964 34 p refs In ITALIAN Repr. from Alluminio (Milan), no. 10, 1963 p 481–487

(SORIN-40)

Purification of aluminum by zone melting is controlled by analysis of impurities. Techniques for analyzing impurities caused by copper, dysprosium, gallium, lanthanum, manganese, and tungsten by means of resistance measurement at low temperature and neutron activation are given. Transl. by P.F.E.

N65-23737# Royal Aircraft Establishment, Farnborough (England).

STUDIES ON KINETICS AND THE MECHANISM OF THE OXIDATION OF HYDROCARBONS IN THE GAS PHASE. PART I: A BRIEF LITERATURE SURVEY ON THE OXIDATION MECHANISM OF HIGHER HYDROCARBONS AND ON THE LOW TEMPERATURE OXIDATION OF n-HEPTANE [STUDIUM DER KINETIK UND DES MECHANISMUS DER OXYDATION VON BENZINKOHLENWASSERSTOFFEN IN DER GASPHASE. I: MITTEILUNG: KURZE LITERATURUBERSICHT UBER DEN TIEFTEMPERATUR MECHANISMUS DER OXYDATION VON HOHEREN KOHLENWASSERSTOFFEN UND UBER DIE TIEFTEMPERATUROXYDATION VON n-HEPTAN]

G. Ohlmann and E. Leibnitz Jan. 1965 25 p refs Transl. into ENGLISH from Z. Physik. Chem. (Leipzig), v. 217, no. 5, 1961 p 408–427

(RAE-LIB-TRANS-1098)

A literature review is made of the mechanism of slow oxidation of the higher hydrocarbons in the low temperature region, the dependence of the rate of oxidation on the structure of hydrocarbons, and the gas phase oxidation of n-heptane. It was concluded that although the literature on the oxidation of higher hydrocarbons is very extensive, the mechanism of low temperature oxidation cannot yet be assumed to be fully understood. Without doubt the peroxy radicals are very significant for the whole course of the reaction in this temperature region. Also, the very strong dependence of the rate of oxidation on the degree of branching of the hydrocarbons is in good agreement with their resistance to knocking, but there is clearly an anomaly in comparison with other reactions of the same hydrocarbons in which as a rule the branched hydrocarbons prove to be the reactive ones. Further, many more investigations, particularly of a quantitative nature, are needed to obtain a complete picture of the mechanism and kinetics of the oxidation of heptane over a wide temperature range. E.E.B.

N65-23857# Public Health Service, Washington, D. C. Div. of Air Polution

SULFUR OXIDES AND OTHER SULFUR COMPOUNDS A Bibliography with Abstracts

Anna Grossmann Copper, comp. 1965 394 p refs *Its* Publ. No. 1093, Bibliog. No. 56 GPO: $2.25

An annotated bibliography of publications from 1893 to 1964 on sulfur oxides and other sulfur compounds was compiled to assist those engaged in studies of sulfur compounds in their relation to air pollution. The bibliography is arranged under 13 subjects. Among the subjects included are studies on sources of oxides of sulfur; emissions composition; atmospheric reactions involving oxides of sulfur; nature of atmospheres; human epidemiology; experimental human exposure to sulfur dioxide; industrial exposures; animal epidemiology; experimental animal exposure to sulfur dioxide; plant epidemiology and experimental exposure of plants; materials damage; visibility reduction; control devices or methods and instrumentation development; and selected publications. The following supplementary indexes are included: title index, author index, and a geographic location index of U.S. and foreign studies. S.C.W.

N65-23860# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
SAMPLE TRANSFER TECHNIQUE FOR SPECTROCHEMICAL ANALYSES. PART I: INVESTIGATION OF CONTACT-SPARK METHOD OF ANALYSIS
Arno Arrak Dec. 1964 20 p refs
(ADR-09-02-64.2)

Emission spectrochemical analysis of large or awkwardly shaped objects which do not fit the arc stand is feasible with a sample transfer technique. The technique described employs a portable device to produce a condenser discharge between the sample and the transfer electrode. The material transferred to the electrode by the condenser discharge is used to produce a spectrum of the sample in the laboratory. Copper and silver transfer electrodes were found to be preferable to graphite, and spark rather than arc excitation more suitable for producing the spectrum. Results on steels and aluminum alloys indicate that definite identification of alloy type and even quantitative analysis of low alloy steels is possible. The method shows promise of being useful in applications where porous cup or similar solution techniques were used, if standards are available, and is less destructive since only shallow surface markings are produced on the sample. Author

N65-23871# European Atomic Energy Community, Brussels (Belgium).
ABSTRACTS ON LABELED COMPOUNDS
H. Dworschak and J. Sirchis 1964 37 p refs
(EUR-2212.e) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 60 Belg. Fr.

References are drawn from 50 primary periodicals and also from NSA and CA. In the latter case reference is made to these abstracting journals. Methods of synthesis and allied problems are indicated. Author

N65-23872# Liege Univ. (Belgium).
LIQUID–LIQUID EXTRACTION OF FERRIC CHLORIDE BY TRI-n-LAURYLAMINE HYDROCHLORIDE
W. Müller (EURATOM), G. Duyckaerts, and F. Maino Brussels, EURATOM, 1965 66 p refs
(Contract EURATOM-003-61-2 TPUB)
(EUR-2245.e) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 85 Belg. Fr.

Extraction from hydrochloric acid or from lithium chloride solutions was studied, using a tracer technique. From a slope analysis of the curves $\log E_a^\circ = f(\log C)$—where E_a° is the extraction coefficient, C is the total amine concentration in the organic phase—it can be concluded that a 2:1 complex (ratio of amine salt to ferric chloride) is extracted from dilute hydrochloric acid or chloride solution. For concentrated chloride solutions, a 1:1 complex is extracted. For aqueous phases which are not too concentrated ($[HCl]_a \leq 5M$; $[LiCl]_a \leq 7M$) the extraction coefficient E_a° of ferric chloride increases to approximately the 3rd power dependence of chloride ion activity $a_{\pm}Cl^-$, defined as $\sqrt{C^2 \cdot \gamma^2_{\pm}}$, c and $\gamma^2_{\pm}$ being the molar concentration and the mean molar activity coefficient of the 1:1 electrolyte. The decrease of iron extraction with increasing acid concentration in pure hydrochloric acid or in mixtures with chlorides can be explained by competition between metal and acid extraction, the latter leading to amine dihydrochloric formation. Author

N65-23873# Liege Univ. (Belgium).
DILUENT INFLUENCE ON LIQUID–LIQUID EXTRACTION BY TRILAURYLAMINE HYDROCHLORIDE
W. Müller and G. Duyckaerts Brussels, Euratom, Feb. 1965 86 p refs
(Contract EURATOM-003-61-2 TPUB)
(EUR-2246.e) Available from Belg. Am. Bank and Trust Co., N.Y., Account No. 22.186: 125 Belg. Fr.

Solubilities of water, hydrogen chloride and trilaurylamine chloride increase with polarizability or polarity of diluents. With few exceptions, water and hydrogen chloride solubilities are proportional to their activities in the aqueous phase, and independent of each other. Hydration favors amine salt solubility. Monohydrated amine hydrochloride is formed in benzene, toluene, nitrobenzene and cyclohexane. In carbon tetrachloride and in chloroform, the hydration of the amine salt is not complete. Analytical results are supported by infrared spectroscopy. The equilibrium constants for the formation of the amine monohydrochloride from organic amine solutions and aqueous hydrochloric acid increase with polarizability or polarity of the diluents. The formation constants of the amine dihydrochloride, however, decrease with increasing polarity with the exception of nitrobenzene. Extraction of ferric or americium chloride from hydrochloric acid of lithium chloride solutions decreases with increasing polarity of diluents, with the exception of nitrobenzene whose extracting power is comparable to that of cyclohexane. Author

N65-23909# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering
NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY. THE EFFECT OF STRUCTURE ON MAGNETIC NON-EQUIVALENCE DUE TO MOLECULAR ASYMMETRY
George M. Whitesides, David Holtz, and John D. Roberts Jan. 1964 34 p refs Submitted for Publication
(Contract Nonr-220(26))
(TR-29; AD-431090)

The difference in chemical shift between the methylene protons of a number of compounds related structurally to 1-phenylethyl benzyl ether was measured. Correlations between structural features of these compounds and the magnitude of the magnetic nonequivalence induced by the center of molecular asymmetry provide basis for qualitative identification of the most important factors contributing to the chemical-shift difference. Although it is clear that no single factor completely determines the magnitude of the methylene proton nonequivalence in these ethers, it is suggested that the proximity of the asymmetric center to the benzyl group results in a preferred conformation of the phenyl ring with respect to the methylene protons, and that the principal contribution to the nonequivalence originates in the magnetic anisotropy of the phenyl group. Author

N65-23910# Dow Chemical Co., Midland, Mich. Thermal Research Lab.
JANAF THERMOCHEMICAL TABLES Quarterly Supplement No. 16
D. R. Stull et al 31 Dec. 1964 154 p refs
(Contract AF 04(611)-7554)
(AD-458422)

N65-23913# Technische Hochschule in Wien (Austria).
KINETIC STUDY OF THE MECHANISM OF REACTIONS OF AROMATIC HYDROXY COMPOUNDS WITH NITROUS ACID AND NITRIC ACID IN NON AQUEOUS SOLVENTS AT VARIOUS TEMPERATURES Annual Technical Report, 1 Jan.–31 Dec. 1963
Hermann Schmid Jan. 1964 90 p refs
(Contract DA-91-591-EUC-2680)
(AD-430903)

The rate equations of the diazotization of the mononitroanilines in methanol, acidified either with perchloric acid or with hydrochloric acid, were determined. The rate determining reactions of these diazotizations were the nitrozation of the nonionized amines by protonated methylnitrite and the nitrozations of nonionized para- and metanitrosylchloride in hydrochloric acidic methanol. Also, the absolute rate coefficients, free activation enthalpy, activation enthalpy, and activation entropy were determined for the diazotization of the chloranilines. The validity of the Brönsted relation between the basic strength of the amines and the free enthalpy of the activation process was confirmed. Further, the nitrozation of phenol in methanol, in aqueous hydrochloric acid, and in carbon tetrachloride was investigated. The nitrozation of phenol in carbon tetrachloride leads to different products than nitrozation in the other solutions. The formation of chlorinated nitrophenols was considered probable. E.E.B.

N65-23914# National Lead Co. of Ohio, Cincinnati. Analytical Dept.

ANALYTICAL CHEMISTRY MANUAL OF THE FEED MATERIALS PRODUCTION CENTER

C. E. Pepper and J. W. Rohnson Washington, AEC, Dec. 1964 542 p refs

(TID-7022(Vol. II)) CFSTI: $5.50

The following are discussed: *Instrumental Analytical Section*—emission spectrochemical laboratory functions, standard practices, and laboratory equipment, chemical preparation procedures, and spectrochemical procedures; *X-Ray Spectrometric Laboratory*—functions, standard practices, and laboratory equipment, principles of X-ray spectrometric analysis, and X-ray spectrometric procedures; *Mass Spectrometer Laboratory*—function, standard practices, and instrumentation; *Radiometric Laboratory*—functions, standard practices, and laboratory equipment, analyses, and radiotracer studies. G.G.

N65-23945# Bologna Univ. (Italy).

RESEARCH INTO THE CHEMICAL BEHAVIOR OF SURFACE OF SINGLE-CRYSTAL AND BI-CRYSTALS UNDER OXIDIZING AND REDUCING CONDITIONS Final Technical Report, 1 Nov. 1963–31 Jan. 1964

Paolo Spinedi [1964] 58 p refs

(Contract DA-91-591-EUC-2744)

(AD-430457)

Oxidation processes on tin, zinc, and germanium single- and bicrystal surfaces at controlled conditions were studied, with pure oxygen, and varying temperature and exposure ranges used in the tests. The observed enhanced reduction process appears to be a direct result of the primary superficial decomposition phenomenon. Micrographs of the surface decomposition and of the first stage of reduction of several hematite single-crystal specimens show a typical decomposition pattern related to the heating up of the reduction temperature. Increased exposure time led to an increase in the size of reduction process zones. In such zones the various reduction products can be identified. G.G.

N65-23977# Argonne National Lab., Ill. Chemistry Div.

THE PURIFICATION OF 10 CURIES OF Cm^{242}

E. P. Horwitz, C. A. A. Bloomquist, H. W. Harvey, D. Cohen, and L. J. Basile Feb. 1965 16 p refs

(Contract W-31-109-ENG-38)

(ANL-6998) CFSTI: $1.00

This report describes the purification of 10 Ci of Cm^{242}, produced by neutron irradiation of $Am^{241}O_2$, encapsulated in high-purity aluminum. The purified curium will be used as an alpha source in an instrument designed to obtain chemical analysis by alpha-particle scattering. The purity requirements for curium employed in such an instrument are the following: high decontamination from capsule material, high decontamination from fission products, high decontamination from chemical reagents used in processing, with the exception of NH_4^+, Cl^-, or NO_3^-, and less than 25% americium in curium by mass. Because of the high level of alpha–gamma activity of irradiated Am^{241}, special equipment was required to process the capsule. The dissolution of the capsule and the separation from fission products were performed by remote control in a high-level cave. A containment box within the cave housed the equipment and apparatus used for processing. After removal of fission products, the gamma activity was reduced sufficiently to allow further processing in a glovebox. Author

N65-23979# Bureau of Mines, Reno, Nev.

EXTRACTION AND SEPARATION OF RARE-EARTH ELEMENTS IN IDAHO EUXENITE CONCENTRATE

Van E. Shaw and D. J. Bauer 1965 17 p refs

(BM-RI-6577)

The characteristics of conversion of euxenite concentrate to sulfates with sulfuric acid and characteristics of solvent extraction of the yttrium-rare-earth mixture with EHPA were studied. Digestion with 3.5 pounds of 96% sulfuric acid per pound of concentrate at 336°C for 4 hours resulted in an easily handled product with a yield in excess of 98%. A thorium-free product was obtained by calcining the sulfated material for 3.5 hours at 650°C prior to leaching with water. Di(2-ethylhexyl)phosphoric acid solvent is an effective extractant with preference for cerium(IV) and heavy-group rare-earth elements including yttrium. Separation of complex rare-earth mixtures into light- and heavy-group fractions is feasible, and these fractions can be further processed to isolate ytterbium, neodymium, and dysprosium by changing processing conditions to obtain separation factors greater than two between these and adjacent elements. Author

N65-24021# Bureau of Mines, Washington, D. C.

APPLICABILITY OF GAS CHROMATOGRAPHIC ANALYSIS IN THERMAL OIL-RECOVERY TESTS

T. E. Sterner 1965 21 p refs

(BM-RI-6621)

Investigated was the use of a chromatographic gas analyzer in determining the concentration of combustion products in gas produced during field and laboratory thermal oil-recovery tests. Several parameters (carrier-gas flow, cell current, sample size, and temperature) known to affect quantitative analyses were studied using a commercially available dual-column, dual-detector chromatographic gas analyzer which had been modified to provide close control of these variables. The apparatus made possible a much closer control of air- and gas-injection rates and provided adequate data for performing material-balance calculations, and for determining oxygen utilization during the laboratory and field combustion tests. The chromatographic analysis also aided materially in evaluating and measuring bypassing and gas travel times, and in detecting high-permeability zones that were present in the reservoir. Author

N65-24070# European Atomic Energy Community, Brussels (Belgium).

OPTIMAL CONDITIONS FOR MASS SPECTROMETRIC QUANTITATIVE DETERMINATIONS BY ISOTOPE DILUTION

P. J. De Bievre and G. H. Debus Jan. 1965 45 p refs

(EUR-2219.e) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 60 Belg. Fr.

Formulas are presented for the calculation of (1) a quantity determined by isotope dilution; (2) the effective precision on this quantity; (3) an a priori estimation and graphical presentation of the attainable precision on the quantity, allowing optimal choice of spike and mixing ratio. The mathematical treatment is based on the normal propagation of statistical errors. Author

N65-24072# Battelle Memorial Inst., Columbus, Ohio.
METALLOGRAPHY OF URANIUM NITRIDE
W. Musser, J. Bugl (EURATOM), and A. A. Bauer Brussels, EURATOM, Jan. 1965 11 p Presented at 17th Metallog. Group Meeting of the USAEC, Los Alamos, N. Mex., 1963
(EUR-2228.e; EURAEC-996) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 25 Belg. Fr.

Techniques were developed for preparation of metallographic samples of uranium nitride. Various etching techniques were found required for optimum phase delineation and identification, depending upon the phases present and type of microstructural detail desired. Author

N65-24084# Brussels Univ. (Belgium). Laboratoire de Chimie Physique Moléculaire
VAPORIZATION OF COMPOUNDS AND ALLOYS AT HIGH TEMPERATURES. PART XVI: THERMOCHEMICAL STUDY OF THE HOMONUCLEAR DIATOMIC MOLECULES AND OF SOME GASEOUS OXIDES OF SCANDIUM YTTRIUM AND LANTHANUM AND OF THE MOLECULE ScC_2
J. Drowart, G. Verhaegen, and S. Smoes Wright-Patterson AFB, AF Mater. Lab., Mar. 1965 20 p refs Presented at the 11th Ann. Conf. on Mass Spectry. and Allied Topics, San Francisco, 20–24 May 1963
(Contract AF 61(052)-225)
(WADD-TR-60-782, Pt. XVI; AD-462138)

A search was made for the molecules Sc_2, Y_2, La_2, and YLa in the vapor of the corresponding elements and alloys. The dissociation energy of these molecules is $D_0^0(Sc_2) = 25.9 \pm 5$; $D_0^0(Y_2) = 37.3 \pm 5$; $D_0^0(La_2) = 57.6 \pm 5$; $D_0^0(YLa) = 47.3 \pm 5$ kcal/mole. The observation of the molecules ScO, Sc_2O, Y_2O, La_2O, Y_2O_2, and La_2O_2 led to the determination of their atomization energy in separate experiments. The values are: $D_0^0(ScO) = 158.8 \pm 5$; $\Delta H_{0.at}^0(Sc_2O) = 245$; $\Delta H_{0.at}^0(Y_2O) = 262$; $\Delta H_{0.at}^0(La_2O) = 265$; $\Delta H_{0.at}^0(Y_2O_2) = 460$; $\Delta H_{0.at}^0La_2O_2) = 475$ kcal/mole. The molecule $ScC_2(g)$ was identified in the system Sc—C. The strength of the bond $Sc—C_2$ is $D_0^0(Sc—C_2) = 146.3 \pm 5$ kcal/mole. Author

N65-24087# General Electric Co., Philadelphia, Pa. Missile and Space Div.
SPECTROSCOPIC STUDIES OF THE VAPORIZATION OF REFRACTORY MATERIALS Technical Report, 1 Nov. 1963–30 Nov. 1964
Milton J. Linevsky Wright-Patterson AFB, Ohio, AF Mater. Lab., Feb. 1965 60 p refs
(Contract AF 33(615)-1150)
(AFML-TR-64-420; AD-461476)

The technique of matrix isolation was used to obtain the infrared spectra of several high temperature molecules. A double boiler and reaction-oven-type Knudsen cell technique were added to the general methods of matrix isolation resulting in greater versatility of the method. Differentiation between monomer and polymer spectra appears to be entirely possible. The following molecules were studied: MgF_2, AlF_3, Li_2F_2, ThO_2, ThO, ZrO_2, and ZrO. In most cases tentative frequency assignments were made, and structural properties inferred. Atomic resonance line absorption studies were carried out on HfB_2, TiN, and ZrN. Heats of formation were obtained based on the observed vapor pressures. Author

N65-24118# AVCO-Everett Research Lab., Everett, Mass.
THEORY OF NON-EQUILIBRIUM DISSOCIATION AND RECOMBINATION Research Report No. 212
James Keck and George Carrier (Harvard Univ.) Apr. 1965 75 p refs
(Contracts AF 04(694)-414; DA-19-020-AMC-0210; Proj. Defender)
(BSD-TR-65-106; AD-462044)

The coupled vibration–dissociation–recombination process for molecules and atoms was examined. Techniques for solving the appropriate master equations for both quantum (discrete) and classical (continuous) models are given. It is shown that the process is most easily treated classically and that in this case the master equation can be reduced to an equivalent diffusion equation. It is also shown that, after an initial vibration transient during which reactions are neglible, the process may be treated using the steady-state approximation. During the steady-state phase, the usual phenomenological rate equations are valid and the ratio of the forward and reverse rate constants is the equilibrium constant, though the individual rate constants are depressed below their equilibrium values. Comparison of the results with other theoretical work shows general agreement for similar models; comparison with shock tube experiments on molecular dissociation and stellarator experiments on ionic recombination is encouraging. Author

N65-24214# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
SOLID-LIQUID PHASE EQUILIBRIUM IN BINARY SYSTEMS OF TRIPHENYL ANTIMONY WITH BIPHENYL, NAPHTHALENE, AND BENZOIC ACID
Marvin S. Brooks Mar. 1965 25 p *Its* Phys. Sci. Res. Paper No. 86
(AFCRL-65-185; AD-614612)

Solid-liquid phase diagrams were obtained from time–temperature cooling curves for the binary systems containing triphenyl antimony with biphenyl, benzoic acid, and naphthalene. These systems were found to be of the single eutectic type. Author

N65-24237# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
REACTIONS OF URANIUM CARBIDE IN A FUSED KCl–LiCl/ZINC SYSTEM
William C. Robinson, Jr. and Premo Chiotti Nov. 1964 112 p refs
(Contract W-7405-ENG-82)
(IS-1061) CFSTI: $4.00

The reactions of uranium monocarbide in a LiCl–KCl–$ZnCl_2$/zinc system are investigated in the temperature range 580° to 802° C. The salt phase is analyzed for uranium and zinc and the mole fraction ratio $K_N = N_{UCl_3}/(N_{ZnCl_2})^{3/2}$ is calculated. The K_N proves to be a function of the moles $ZnCl_2$/moles UC charged with the uranium remaining in the zinc phase present as an oxygen-enriched uranium monocarbide at values of K_N greater than 20 and as UO_2 at values of K_N less than 15. All of the uranium in the uranium monocarbide charged is never oxidized into the salt even when K_N's as low as 0.21 are obtained. These results indicate that the uranium monocarbide lattice is being stabilized by oxygen. An EMF cell of the type U/LiCl-KCl-UCl_3/UO_xC_{1-x}, C was utilized to investigate the increase in chemical potential of uranium in the uranium oxycarbide phase as a function of oxygen composition from 0.35 to 0.82 mole fraction UO and temperature

from 460° to 760° C. Extrapolation of the data obtained to zero oxygen concentration is shown to yield the free energy of formation of UC as a function of temperature. The equation obtained is $\Delta F°_{UC} = -16916 - 1.90T$. Author

N65-24250# Oak Ridge National Lab., Tenn. Chemical Technology Div.
TRANSURANIUM Quarterly Progress Report, Period Ending Aug. 31, 1964
W. D. Burch May 1965 81 p refs
(Contract W-7405-ENG-26)
(ORNL-3739) CFSTI: $3.00

Continued research conducted under the transuranium program, which is directed toward the production of sizable quantities of the heavy actinide elements for laboratory research, is reported. Progress reports are included on the development of separation processes for the transuranium elements, process equipment development, high flux isotope reactor (HFIR) target fabrication development, construction of the transuranium processing plant, corrosion studies, and analytical research and development. S.C.W.

N65-24252# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY PROGRESS REPORT FOR FEBRUARY 1965
J. F. Eichelberger, G. R. Grove, and L. V. Jones 30 Apr. 1965 27 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1245)

Continued research is reported in the following areas: *Radioelements, Isotope Separation and Purification,* and *Analytical and Instrumentation* techniques. Progress in basic and applied research on several radioelements which is designed to determine their physical properties, to develop analytical techniques, and to study the basic radiochemistry involved, is reported. Emphasized are alpha emitters, their decay chains, isotopes, and chemical homologs. Data are presented on polonium-208/209, half-life determination by decaying pairs, actinium^{227}, and uranium^{234}. Methods of separation and purification of the following isotopes are given: carbon^{13}, argon xenon, and oxygen. Progress in thermal diffusion research is also included. Instrumental techniques and standard wet methods for analyzing elements and compounds are discussed. Data on the redesign of the Lucite irradiation chamber of the gamma activation analysis facility for beryllium, the development of a method for determining impurities in plutonium residue samples, the fabrication of an aluminum block calorimeter for measuring heats of polymerization of several polymers over a temperature range of −20° C to +50° C, and the experimental development of techniques for preparing and reworking semiconductor radiation detectors, are presented. S.C.W.

N65-24253# Goodyear Atomic Corp., Piketon, Ohio. Chemical Analysis Dept.
THE MICRODETERMINATION OF SULFUR IN URANIUM COMPOUNDS
C. R. Walker and C. F. Trivisonno 15 Mar. 1965 13 p refs
(Contract AT(33-2)-1)
(GAT-501) CFSTI: $1.00

A method was developed for determining microgram quantities of sulfur in uranium compounds. The sulfur is reduced and distilled as hydrogen sulfide from a mixture of hydrochloric, hydriodic, hypophosphorous, and phosphoric acids. The distilled hydrogen sulfide is treated with cupric ion in an acetate medium at pH 4.8 to 6.0 to produce the brown color of cupric sulfide. The color is sufficiently stable for a colorimetric determination of sulfur at a wavelength of 350 millimicrons. Nitrate, which interferes with the determination, is easily removed before the analysis. This method detects a minimum of 1 to 2 micrograms of sulfur while the limit of error in the 1 to 50 microgram range is 8% at the 95% confidence interval. Author

N65-24261# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station
CALCULATION OF THE VAPOR PRESSURE AND HEATS OF VAPORIZATION AND SUBLIMATION OF LIQUIDS AND SOLIDS BELOW ONE ATMOSPHERE PRESSURE. VI: KRYPTON
W. T. Ziegler, D. W. Yarbrough, and J. C. Mullins 15 Jul. 1964 51 p refs
(Contract NBS CST-1154)
(TR-1)

Available experimental thermal and second virial coefficient data, together with suitable thermodynamic relations, were used to compute the vapor pressure and heats of vaporization and sublimation of krypton at 1° intervals from 119.786° K (normal boiling point) to 12° K. The effect on the computed results of varying separately the heat of vaporization at the normal boiling point and the second virial coefficient of krypton was examined. In order to obtain reasonably good agreement between the experimental and computed vapor pressures it was found necessary to use a heat of vaporization at the normal boiling point of 2154 cal/gm mole, a value approximately 0.35% smaller than the best experimental value. The input data for the calculations were used to compute the heat of sublimation of krypton at 0° K and the calorimetric entropy of krypton in the ideal gas state at 119.786° K. The computed vapor pressures are believed to represent the vapor pressure of krypton as a function of temperature below 119.786° K very nearly within the uncertainty of the experimental data. They are especially recommended for use below 75° K where experimental data are scanty or lacking. Author

N65-24275 United Kingdom Atomic Energy Authority, Harwell (England). Library
L.E.T. EFFECTS IN RADIATION CHEMISTRY
Masashi Imamura Nov. 1964 24 p refs Transl. into ENGLISH from Nihon Genshiryoku Gakkaishi (Tokyo), v. 6, no. 4, 1963 p 218–227
(AERE-TRANS-1019) HMSO: 3s 6d

Effects of linear energy transfer (LET) on the product yields of the radiolysis of water have been studied at length and explained satisfactorily by the diffusion theory developed by Magee and his co-workers. If similar discussions are assumed applicable to liquid systems other than water, the more detailed mechanisms of the radiolyses must be obtained. Though relatively few papers have been published of the LET effects for the non-aqueous systems, some examples, that is, methanol, cyclohexane, cyclohexene, benzene and its derivatives, which were studied systematically to some extent, are reviewed. Special systems are also reviewed briefly. Author

N65-24278 United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
INHIBITORS FOR THE CO_2-GRAPHITE REACTION IN REACTORS — PRELIMINARY SURVEY
M. Tomlinson and J. Wright 1965 29 p refs
(AERE-R-4201) HMSO: 4s

Preliminary experiments in sealed tubes at 140° and 500° C in BEPO, with a gas density of about 50 mg/cm^{-3} and conditions favoring attack by irradiated gas in the interstices of a

powder have shown that some gaseous additives present at about 2% in CO_2 can reduce the radiolytic oxidation of carbon. Carbon monoxide was not very effective, but SO_2, Cl_2 and (less certainly) I_2 reduced the rate of gasification by factors of 5 to 15. At the higher temperature the halogens required the simultaneous presence of CO in order to be effective. Hydrocarbons and organic additives generally produced heavy carbonaceous deposits. Lighter deposits were also found in tubes containing appreciable carbon monoxide either added initially or built up during the irradiation. The sealed tube technique is more suitable for studies of additives which affect the gas phase steps in the oxidation than those like methane, which interfere with processes on the graphite surface. For studies of the latter kind, gas flow experiments are required. Author

N65-24300*# Aerojet-General Corp., Azusa, Calif. Chemical Products Div.

RESEARCH ON PROCESSES FOR UTILIZATION OF LUNAR RESOURCES Quarterly Report No. 1765-03-3, 16 Jan.–15 Apr. 1965

S. D. Rosenberg, G. A. Guter, F. E. Miller, and R. L. Beegle Apr. 1965 34 p

(Contract NAS7-225)

(NASA-CR-62857) CFSTI: HC $2.00/MF $0.50

Seven runs were completed with the silicate reduction furnace. Reductions with graphite gave up to 86% conversion of carbon to carbon monoxide, while reducing 50% of the silicate. The second long-duration run with the carbon monoxide reduction apparatus gave excellent conversions and product yields after 54 days of operation. Author

N65-24321# Atomic Weapons Research Establishment, Aldermaston (England).

THE DETERMINATION OF TRACES OF URANIUM BY DELAYED NEUTRON EMISSION

W. H. Davies and R. F. Coleman Nov. 1964 12 p ref

(AWRE-O-88/64)

A method is described for the rapid determination of traces of uranium by measuring the delayed neutron emission after fission. The sample, usually in 30 ml of solution, is irradiated for 1 min, allowed to cool for 25 sec and counted for 1 min in an efficient boron trifluoride counter. A sensitivity of 7×10^{-9}g U-235/liter can be obtained without concentrating the solution or performing chemical separations. The irradiated solution is removed from its container prior to counting to eliminate the effect of traces of uranium in the container and an apparatus for the rapid transference of the solution is described. Author

N65-24322# Atomic Weapons Research Establishment, Aldermaston (England).

THE FORMATION OF POLYESTERS AND POLYURETHANE FOAMS FROM LACTONE MONOMERS

C. R. Thomas Nov. 1964 14 p refs

(AWRE-O-93/64)

Condensation of a trihydric alcohol with lactones to give hydroxyl terminated polyesters suitable for polyurethane foam formation was studied. With lactones containing six- or seven-membered rings the condensations gave low viscosity polyesters. It was not possible to obtain condensation products from lactones with five-membered rings, whereas with four-membered ring lactones the condensation was vigorous. These observations are in accordance with the ease of ring cleavage of the lactones which passes through a minimum with the five-membered rings. Polyurethane foams obtained from the six- and seven-membered lactone polyesters and tolylene diisocyanate were rigid at room temperature but became rubbery at 70° C. They were inferior in strength and temperature resistance to foams obtained from tolylene diisocyanate and a conventional polyester. Author

N65-24324 Atomic Weapons Research Establishment, Aldermaston (England).

SOLUBILITY OF THE PLUTONIUM CONTENT OF PARTICULATE MATERIAL COLLECTED DURING OPERATION ROLLER COASTER

A. P. Ballance and B. J. Wells Feb. 1965 7 p

(AWRE-O-11/65) HMSO: 1s 2d

This report describes special type of solubility measurements involving diffusion through a cellophane membrane. Results are reported; their significance is discussed. Author

N65-24333# Bureau of Mines, College Park, Md. College Park Metallurgy Research Center

MECHANISM OF THE MONOCLINIC TO TETRAGONAL TRANSFORMATION OF ZIRCONIUM DIOXIDE

Clark F. Grain and Ronald C. Garvie 1965 23 p refs

(BM-RI-6619)

The monoclinic to tetragonal inversion of zirconium dioxide was studied by single-crystal X-ray methods, high-temperature X-ray diffractometry, and differential thermal analysis. The usual features of the inversion, such as no definite transition temperature, hysteresis, and athermal kinetics, were confirmed for powders whose mean crystallite size was greater than 1000 Å. Samples of mean crystallite size below 1000 Å displayed classical kinetics, obeying a logarithmic rate law. A detailed mechanism based on Ubbelohde's theory of continuous phase transformations was proposed which is consistent with all the experimental facts. Author

N65-24347# Los Alamos Scientific Lab., N. Mex.

THE SPECTROPHOTOMETRIC DETERMINATION OF SILICON IN PLUTONIUM

T. K. Marshall, K. S. Bergstresser, and G. R. Waterbury 7 Apr. 1965 16 p refs

(Contract W-7405-ENG-36)

(LA-3247) CFSTI: $1.00

Microgram quantities of silicon are separed from plutonium by selectively precipitating plutonium (III) and (IV) fluoride, and the silicon in the supernatant solution is determined spectrophotometrically as the reduced silicomolybdic acid complex. Boric acid is used to complex and prevent interference caused by the excess fluoride ion during the formation of the blue silicomolybdic acid complex. The absorbance of the complex is measured at a wavelength of 825 mμ. Based upon 14 determinations each of 52, 104, and 152 ppm of silicon in plutonium (10.4, 20.8, or 31.4 μg of silicon added to 200 mg of plutonium) the relative standard deviation of the method was found to be 3.7% 1.8% and 2.8%, respectively. The molar absorptivity of 16 600 calculated from these data shows that 10 ppm (2 μg of silicon in a 200-mg plutonium sample) can be determined reliably. High concentrations of chromium, germanium, iron, nickel, or potassium interfere in this determination. Author

N65-24361# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center

COMPATIBILITY OF MATERIALS WITH ROCKET PROPELLANTS AND OXIDIZERS

W. K. Boyd, W. E. Berry, and E. L. White 29 Jan. 1965 45 p refs

(Contract AF 33(615)-1121)

(DMIC-MEMO-201; AD-613553)

Compatibility data are summarized for the storage and handling of metals and nonmetals in the following rocket propellants and oxidizers: ammonia, HiCal-3, pentaborane, trialkyl boranes, fluorine, FLOX, oxygen difluoride, ozone difluoride, chlorine trifluoride, bromine trifluoride, bromine pentafluoride, iodine pentafluoride, perchloryl fluoride, halogenated hydrocarbons, hydrazine, monomethyl hydrazine, unsymmetrical dimethyl hydrazine, Aerozine-50 hydrogen, hydrogen peroxide, methylene chloride, red fuming nitric acid, white fuming nitric acid, concentrated acid, nitrogen tetroxide, oxygen, ozone, nitronium perchlorate, and solid propellant ANP-2639 AF. Author

N65-24368# Little (Arthur D.), Inc., Cambridge, Mass.
GASEOUS METABORATES. III: THE BERYLLIUM OXIDE-BORON OXIDE SYSTEM. RESEARCH ON THERMODYNAMICS OF THE Al-B-O AND Al-Be-O SYSTEMS Interim Technical Report
Paul E. Blackburn and Alfred Büchler Mar. 1965 26 p refs (Contract AF 49(638)-1171)
(ITR-1; AD-613660)

Gaseous beryllium metaborate, $Be(BO_2)_2$, was identified mass spectrometrically in the vapor above the beryllium–boron–oxygen system. A study by differential thermal analysis and Knudsen effusion using a vacuum balance and mass spectrometer, showed solid $Be_3B_2O_6$ to be the only condensed mixed oxide phase present with a melting point of 1495 ±5° C. The metal–anion bond strengths in the gaseous lithium and beryllium metaborates show the same relation to each other as the bond strengths in the corresponding chlorides, thus further confirming the pseudohalide character of the gaseous metaborates. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N65-23425# National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.
BULLETIN OF THE RADIO AND ELECTRICAL ENGINEERING DIVISION, Vol. 14, No. 4, October–December 1964
Dec. 1964 54 p refs

CONTENTS:

1. NEW FACILITIES FOR D-C CORONA RESEARCH R. M. Morris p 1–3 refs (See N65-23426 13-11)
2. A LABORATORY STUDY OF THE EFFECTS OF WIND ON D-C CORONA M. M. Khalifa and R. M. Morris p 4–7 refs (See N65-23427 13-10)
3. SPHERE GAP VOLT-TIME CURVES F. C. Creed p 8–14 refs (See N65-23428 13-09)
4. AN ANTENNA DESIGNED FOR THE INVESTIGATION OF PRECIPITATION PHENOMENA G. C. McCormick p 15–23 refs (See N65-23429 13-07)
5. AN INTERCOMPARISON OF NATIONAL STANDARDS OF RADIO-FREQUENCY POWER R. F. Clark p 23–26 refs (See N65-23430 13-07)
6. THE STATE OF CARBON MONOXIDE ADSORBED ON A TUNGSTEN (211) SURFACE R. A. Armstrong p 26–37 refs (See N65-23431 13-24)
7. AIDS TO NAVIGATION p 37–40
8. OBSERVING PROGRAMS FOR THE 150-FOOT RADIO-TELESCOPE p 41
9. WEIGHT-OF-THE-PRECIPITATION TELEMETRY p 41

N65-23429 National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.
AN ANTENNA DESIGNED FOR THE INVESTIGATION OF PRECIPITATION PHENOMENA
G. C. Mc Cormick *In its* Bull. of the Radio and Elec. Engr. Div., Vol. 14, No. 4, Oct.-Dec. 1964 Dec. 1964 p 15–23 refs (See N65-23425 13-07)

An antenna with polarization uniformity over the entire beam was developed with a means provided to change or cycle the polarization in an arbitrary manner. A reflector feed capable of the desired polarization diversity and uniformity will generally aim at the following ideal properties: (1) rotation symmetry, (2) equality of the E-plane and H-plane power patterns, and (3) equality of the E-plane and H-plane phase patterns. An open-ended circular waveguide with a very short wide-flared horn satisfies the first and very nearly satisfies the second. However, the internal and external E-plane currents at the horn mouth generate an appreciable difference in the phase patterns of what would otherwise be an ideal feed. This horn was fed with circular polarization by means of a conventional turnstile junction and produced circular polarization with an axial ratio of 1:00 on the peak of the beam. However, the axial ratio was found to deteriorate to 0:90 at the 30 dB points and to 0.66 at the 10 dB points. It was estimated that the antenna described should permit a cancellation ratio of 37 dB against an ideal target. E.E.B.

N65-23430 National Research Council of Canada, Ottawa (Ontario). Radio and and Electrical Engineering Div.
AN INTERCOMPARISON OF NATIONAL STANDARDS OF RADIO-FREQUENCY POWER
R. F. Clark *In its* Bull. of the Radio and Elec. Engr. Div., Vol. 14, No. 4, Oct.-Dec. 1964 Dec. 1964 p 23–26 refs (See N65-23425 13-07)

An intercomparison of power standards is described. A transfer standard was used to provide effectively the same radiofrequency power input to both power standards. The transfer standard consisted of a coaxial directional coupler with a thermistor mount located on its side arm. It was calibrated at 300 Mc/sec and 1000 Mc/sec with reference to the power standard, and then calibrated against the NBS power standard. The experimental arrangement for the calibration of the transfer standard is shown and the procedure is described. The summation of the systematic errors gave 0.24% at 300 Mc/sec and 0.32% at 1000 Mc/sec. The estimated accuracy of the NBS calorimeter was ±0.3% at 300 Mc/sec and ±0.4% at 1000 Mc/sec for the other standard. E.E.B.

N65-23433 Library of Congress, Washington, D. C. Aerospace Technology Div.
GAS MAINS AS WAVEGUIDES
Stuart G. Hibben *In its* Foreign Sci. Bull., Vol. 1, No. 5 May 1965 p 1–5 refs (See N65-23432 13-34)

The feasibility was studied of using standard gas mains up to 1 meter in diameter as waveguides for point-to-point microwave transmission. With proper conductive coatings on the interior surfaces, steel gas mains are suitable for low-loss, noise-free propagation of microwaves over distances which exceed

the usual intervals between pumping stations on the line. The TE_{11} and TE_{01} modes are analyzed as being the most suitable for this purpose. Critical factors such as dimensional tolerances, bend radii, and coating methods are evaluated. Calculated data are given for propagation in the 15- to 30-cm band of 125 channels of amplitude-modulated TV over a 1-m-diameter pipeline. Author

N65-23568# Academy of Sciences (USSR), Moscow. Astronomical Council
OPTICAL OBSERVATION STATIONS OF ARTIFICIAL EARTH SATELLITES, BULLETIN NO. 39 [STANTSII OPTICHESKOGO NABLYUDENIYA ISKUSSTVENNYKH SPUTNIKOV ZEMLI, BYULLETIN NO. 39]
1964 37 p refs In RUSSIAN

CONTENTS:

1. REDUCTION OF SIMULTANEOUS SATELLITE OBSERVATIONS V. M. Amelin p 3–8 refs (See N65-23569 13-07)

2. APPLICATION OF THE "GEOMETRICAL METHOD" FOR THE REDUCTION OF SIMULTANEOUS OBSERVATIONS OF ECHO-1 G. V. Panova and D. E. Shchegolev p 8–10 refs (See N65-23570 13-07)

3. COMPUTATION OF EQUATORIAL TOPOCENTRICAL SATELLITE POSITIONS B. M. Klenitsky and G. A. Ustinov p 10–12 (See N65-23571 13-07)

4. SIMULTANEOUS PHOTOGRAPHIC TRACKING OF ARTIFICIAL SATELLITES IN AN EXPEDITION A. G. Krylov and V. A. Jurevitch p 12–15 refs (See N65-23572 13-07)

5. ON THE OBSERVATIONS OF ARTIFICIAL SATELLITES OBSCURED BY THE SHADOW OF THE EARTH V. G. Fessenkov p 16–17 (See N65-23573 13-07)

6. PHOTOMETRIC OBSERVATIONS OF ARTIFICIAL SATELLITES OBSCURED BY THE SHADOW OF THE EARTH D. A. Rozhkovsky p 17–19 (See N65-23574 13-07)

7. A GRAPHICAL METHOD FOR DETERMINING THE HEIGHT OF THE SHADOW ABOVE THE SURFACE OF THE EARTH V. A. Vorotnikov p 19–21 (See N65-23575 13-13)

8. RESULTS OF PHOTOGRAPHIC SATELLITE TRACKING p 22–34

N65-23569 Academy of Sciences (USSR), Moscow. Astronomical Council
REDUCTION OF SIMULTANEOUS SATELLITE OBSERVATIONS [OPYT OBRABOTKI SINKHRONNYKH NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI]
V. M. Amelin *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 39 Jun. 1964 p 3–8 refs In RUSSIAN; ENGLISH summary (See N65-23568 13-07)

Simultaneous tracking of satellites for geodetic purposes is discussed. Two problems are considered: estimation of satellite positions from simultaneous tracking data and of coordinates of an unknown station. Results of reduction of photographic simultaneous tracking data of the balloon-satellite Echo-I are given. Author

N65-23570 Academy of Sciences (USSR), Moscow. Astronomical Council
APPLICATION OF THE "GEOMETRICAL METHOD" FOR THE REDUCTION OF SIMULTANEOUS OBSERVATIONS OF ECHO-1 [PRIMENENIE "GEOMETRICHESKOGO METODA" K OBRABOTKE SINKHRONNYKH NABLYUDENII SPUTNIKA "EKHO-I"]
G. V. Panova and D. E. Shchegolev *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 39 Jun. 1964 p 8–10 refs In RUSSIAN; ENGLISH summary (See N65-23568 13-07)

An example of calculation of satellite positions and of the coordinates of a tracking station with the aid of formulas of the analytical geometry is given. Author

N65-23571 Academy of Sciences (USSR), Moscow. Astronomical Council
COMPUTATION OF EQUATORIAL TOPOCENTRICAL SATELLITE POSITIONS [VYCHISLENIE E EKVATORIAL' NYKH TOPOTSENTRICHESKIKH KOORDINAT ISZ]
B. M. Klenitsky and G. A. Ustinov *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 39 Jun. 1964 p 10–12 In RUSSIAN; ENGLISH summary (See N65-23568 13-07)

Methods of computations of satellite equatorial topocentrical positions are described. Formulas for the estimation of the accuracy of the obtained values ($m\alpha$ and $m\delta$) are evaluated. Estimation of systematic timing errors at the participating tracking stations that can be discovered during leveling in the geodetic processing of the data as well as the way to evaluate the necessary coefficients, is given. Author

N65-23572 Academy of Sciences (USSR), Moscow. Astronomical Council
SIMULTANEOUS PHOTOGRAPHIC TRACKING OF ARTIFICIAL SATELLITES IN AN EXPEDITION [SINKHRONNYE FOTOGRAFICHESKIE NABLYUDENIYA ISKUSSTVENNYKH SPUTNIKOV ZEMLI V EKSPEDITSIONNYKH USLOVIYAKH]
A. G. Krylov and V. A. Jurevitch *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 39 Jun. 1964 p 12–15 refs In RUSSIAN (See N65-23568 13-07)

Several temporary experimental photographic stations set up for synchronized observation of Echo I during May and June 1963 are described. Since these stations were functioning under expeditional conditions, the data obtained lack accuracy. Preparations for the expeditions, characteristics of the cameras used, analysis of the time deviations, description of the stations, and site selection are among the topics discussed. M.P.G.

N65-23573 Academy of Sciences (USSR), Moscow. Astronomical Council
ON THE OBSERVATIONS OF ARTIFICIAL SATELLITES OBSCURED BY THE SHADOW OF THE EARTH [O NABLYUDENII ISKUSSTVENNYKH SPUTNIKOV PRI VKHOZHDENII ICH V ZMNUYU TEN']
V. G. Fessenkov *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 39 Jun. 1964 p 16–17 In RUSSIAN; ENGLISH summary (See N65-23568 13-07)

Methodical instructions for the observations of satellites obscured by the shadow of the earth are given. Author

N65-23574 Academy of Sciences (USSR), Moscow. Astronomical Council
PHOTOMETRIC OBSERVATIONS OF ARTIFICIAL SATELLITES OBSCURED BY THE SHADOW OF THE EARTH [FOTOMETRICHESKIE NABLYUDENIYA ISZ, VKHODYASHCHEGO V ZEMNUYU TEN']
D. A. Rozhkovsky *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 39 Jun. 1964 p 17–19 In RUSSIAN; ENGLISH summary (See N65-23568 13-07)

A method of photometric observations of satellites is described. Estimation of the satellite brightness is based on photographs of its track photometrically calibrated with the help of a series of tracks obtained on the plates from stars with known magnitudes. Author

N65-23577# Academy of Sciences (USSR), Moscow. Astronomical Council

OPTICAL OBSERVATION STATIONS OF ARTIFICIAL EARTH SATELLITES, BULLETIN NO. 38 [STANTSII OPTICHESKOGO NABLYUDENIYA ISKUSSTVENNYKH SPUTNIKOV ZEMLI, BYULLETEN' NO. 38]

Jun. 1964 45 p refs In RUSSIAN

CONTENTS:

1. AN ATTEMPT TO PHOTOGRAPH A FLASH LIGHT ON THE BACKGROUND OF THE STARS A. M. Lolinsky, V. I. Belenko, G. V. Romanova, A. S. Beloborodova, and A. M. Shilkin p 3–6 (See N65-23578 13-30)

2. DETERMINATION OF THE DISTORTION AND THE FOCAL LENGTH FOR THE OBJECTIVE-LENS OF THE CAMERA NAFA-3c/25 AND A CAMERA WITH A MOVING FILM A. G. Kirichenko and A. A. Sychev p 6–8 refs (See N65-23579 13-30)

3. INVESTIGATION OF A CAMERA WITH A MOVING FILM I. V. Shvalagin p 9–13 refs (See N65-23580 13-07)

4. A NEW NET OF BINOCULAR THREADS V. A. Merkushev p 14–17 refs (See N65-23581 13-07)

5. A VIEW-FINDER FOR SATELLITES ON THE BASE OF A TELESCOPE AT-1 L. A. Panaiotov p 17–18 (See N65-23582 13-14)

6. SIMULTANEOUS TRACKING OF SATELLITES FOR SPACE GEODESY B. A. Firago p 18–21 refs (See N65-23583 13-07)

7. THE DEVIATION OF THE APPARENT TRACK OF A SATELLITE ON THE CELESTIAL SPHERE FROM THE LARGE CIRCLE IN THE CASE OF A CIRCULAR ORBIT V. I. Belenko p 22–24 (See N65-23584 13-07)

8. ON THE DEVIATION OF THE APPARENT SATELLITE ORBIT FROM THE ARC OF A LARGE CIRCLE G. A. Leikin p 24–26 (See N65-23585 13-07)

9. PRELIMINARY ORBITAL ELEMENTS OF ARTIFICIAL EARTH SATELLITES "KOSMOS 2", "KOSMOS 3" AND "KOSMOS 5" G. A. Chebotarev and E. N. Makarova p 26–27 ref (See N65-23586 13-07)

10. PRELIMINARY MEAN ORBITAL ELEMENTS OF THE CABIN OF THE FIRST SOVIET SPACE SHIP (1960 ε 3) FOR JANUARY–JUNE 1963 G. A. Chebotarev and E. N. Makarova p 27–29 (See N65-23587 13-30)

11. RESULTS OF SATELLITE TRACKING p 29–41

N65-23580 Academy of Sciences (USSR), Moscow. Astronomical Council

INVESTIGATION OF A CAMERA WITH A MOVING FILM [ISSLEDOVANIE KAMERY S PODVISHNOY PLENKOY]

I. V. Shvalagin *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964 p 9–13 refs In RUSSIAN; ENGLISH summary (See N65-23577 13-07)

A series of photographs was obtained simultaneously with a camera NAFA-3c and a camera KPP (with a moving film). An estimate of the accuracy of satellite positions is given relative to the camera KPP. Author

N65-23581 Academy of Sciences (USSR), Moscow. Astronomical Council

A NEW NET OF BINOCULAR THREADS [NOVAYA SETKA NITEV BINOKULYARA]

V. A. Merkushev *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964 p 14–17 refs In RUSSIAN; ENGLISH summary (See N65-23577 13-07)

A special net proposed permits elimination of rough errors in the determination of time, orientation of the circles, and ensuring the passage of satellites near the center of sight of the telescopes. Author

N65-23583 Academy of Sciences (USSR), Moscow. Astronomical Council

SIMULTANEOUS TRACKING OF SATELLITES FOR SPACE GEODESY [OB ISPOL'ZOVANII SINKHRONNYKH NABLYUDENIY SPUTNIKOV V KOSMICHESKOY GEODEZII]

B. A. Firago *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964 p 18–21 ref In RUSSIAN; ENGLISH summary (See N65-23577 13-07)

One of the possible solutions of the direct and indirect problems of space geodesy with the aid of simultaneous tracking of satellites is considered. The levelling of the tracking data and the coordinates of the reporting stations is carried out by using successively the least squares method for the equations of the lines of sight. Systematical timing errors and inaccuracies of the geodetic coordinates of individual stations may be discovered and eliminated. Author

N65-23584 Academy of Sciences (USSR), Moscow. Astronomical Council

THE DEVIATION OF THE APPARENT TRACK OF A SATELLITE ON THE CELESTIAL SPHERE FROM THE LARGE CIRCLE IN THE CASE OF A CIRCULAR ORBIT [OTKLONENIE VIDIMOGO PUTI ISZ NA NEBESNOY SFERE OT DUGI BOL'SHOGO KRUGA DLYA SLUCHAYA KRUGOVOY ORBITY]

V. I. Belenko *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964 p 22–24 In RUSSIAN; ENGLISH summary (See N65-23577 13-07)

For a circular satellite orbit a formula for the angular deviation of the apparent track of a satellite on the celestial sphere from the arc of a large circle coinciding with this track in the point approaching the observer is evaluated. The dependence on the length of this arc (which is read from the point of approach), on the zenith length of the point of approach and on the linear height of the orbit above the surface of a spherical earth is investigated. A table of angular deviations for different initial data is given. Author

N65-23585 Academy of Sciences (USSR), Moscow. Astronomical Council

ON THE DEVIATION OF THE APPARENT SATELLITE ORBIT FROM THE ARC OF A LARGE CIRCLE [OB OTKLONENII VIDIMOY ORBITY SPUTNIKA OT DUGI BOL'SHOGO KRUGA]

G. A. Leikin *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964 p 24–26 In RUSSIAN; ENGLISH summary (See N65-23577 13-07)

A formula is given describing the deviation of an apparent track of a satellite moving along a circular orbit from the arc of the large circle. Author

N65-23586 Academy of Sciences (USSR), Moscow. Astronomical Council

PRELIMINARY ORBITAL ELEMENTS OF ARTIFICIAL EARTH SATELLITES "KOSMOS-2", "KOSMOS-3" AND "KOSMOS-5" [PREDVARITEL'NYE ELEMENTY ORBIT ISKUSSTVENNYKH SPUTNIKOV ZEMLI "KOSMOS-2", "KOSMOS-3" I "KOSMOS-5"]

G. A. Chebotarev and E. N. Makarova *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964. p 26–27 ref In RUSSIAN (See N65-23577 13-07)

Preliminary orbital elements of Cosmos 2, 3, and 5 were analyzed according to the method of Haus and Bazhenov. The systems of orbital elements obtained were improved by the method of the Institute of Theoretical Astronomy. The final results are tabulated. M.P.G.

N65-23625# Academy of Sciences (USSR), Moscow. Astronomical Council

OPTICAL OBSERVATION STATIONS OF ARTIFICIAL EARTH SATELLITES, BULLETIN NO. 40 [STANTSII OPTICHESKOGO NABLYUDENIYA ISKUSSTVENNYKH SPUTNIKOV ZEMLI, BYULLETIN NO. 40]

1964 53 p refs In RUSSIAN

CONTENTS:

1. AN AZIMUTHAL MOUNTING OF A TRACKING CAMERA A. A. Logvinenko p 3–6 ref (See N65-23626 13-14)

2. A SEMIAUTOMATIC FILM WINDING DEVICE FOR THE NAFA 3c/25 CAMERA A. A. Logvinenko p 6–8 ref (See N65-23627 13-14)

3. RECONSTRUCTION OF SHUTTERS OF THE CAMERAS NAFA 3c/50 AND NAFA 3c/25 AT THE KRASNODAR TRACKING STATION V. N. Ivanov and I. D. Bregeda p 9–11 (See N65-23628 13-14)

4. AUTOMATIC OPERATION OF THE SHUTTER OF THE PHOTOGRAPHIC TRACKING CAMERA NAFA 3s/25 K. Lapushka p 11–16 (See N65-23629 13-14)

5. OPERATION OF THE SHUTTER FOR THE NAFA 3c/25 CAMERA AND ACCURACY OF TIMING AT THE KHARKOV STATION P. P. Pavlenko p 16–17 (See N65-23630 13-14)

6. AN OPERATION DESK FOR A SATELLITE TRACKING STATION E. A. Pavlyniv, Yu. I. Safronov, and V. A. Melenevskiy-Grishchenko p 18–19 (See N65-23631 13-11)

7. ON THE VARIATIONS IN THE DELAY OF RADIO SIGNALS IN THE PRV RECEIVER B. I. Fedorov p 19–20 (See N65-23632 13-07)

8. MARKING OF THE IMPRINTS OF A CHRONOGRAPH A. A. Logvinenko, I. I. Terebushko, and V. V. Tret'yakov p 20–22 ref (See N65-23633 13-14)

9. THE USE OF A RADIO SET FOR BROADCASTING OF TIME SIGNALS FROM A CONTACT CHRONOMETER A. F. Ivanov p 22–23 (See N65-23634 13-07)

10. ON THE ACCURACY OF VISUAL TRACKING OF SATELLITES USING A SHUTTER Z. S. Shilkina p 23–25 ref (See N65-23635 13-07)

11. ON THE RECEPTION OF TIME SIGNALS FOR PHOTOGRAPHIC OBSERVATIONS OF SATELLITES K. Lapushka p 25–28 (See N65-23636 13-07)

12. THE USE OF QUARTZ CLOCK FREQUENCIES FOR DRIVING THE SYNCHRONOUS MOTOR OF A PRINTING CHRONOGRAPH K. Lapushka p 28–30 (See N65-23637 13-14)

13. PROTECTION OF THE OPTICS OF TRACKING TELESCOPES FROM PERSPIRATION AND FROSTING V. V. Shmeling p 30–32 (See N65-23638 13-14)

14. MULTIPLE TIMING FOR DETERMINING CORRECTIONS FOR THE ALTITUDE AND THE AZIMUTH OF A SATELLITE V. A. Merkushev p 32–34 (See N65-23639 13-07)

15. AVERAGE ORBITAL ELEMENTS OF THE CABIN OF THE FIRST SOVIET SPACE SHIP (1960 ι_3) FOR AUGUST-DECEMBER 1963 G. A. Chebotarev and E. N. Makarova p 34–36 (See N65-23640 13-30)

16. RESULTS OF PHOTOGRAPHIC TRACKING OF SATELLITES p 36–41

N65-23632 Academy of Sciences (USSR), Moscow. Astronomical Council

ON THE VARIATIONS IN THE DELAY OF RADIO SIGNALS IN THE PRV RECEIVER [OB IZMENENIYAKH ZAPAZDYVANIYA RADIOSIGNALOV V PRIYEMNIKE PRV]

B. I. Fedorov *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 19–20 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

Variations in the delay of radio signals in the circuit, receiver-impulse relay and the delay of the entire channel, and receiver-impulse relay-chronograph for one tracking data are considered. Author

N65-23634 Academy of Sciences (USSR), Moscow. Astronomical Council

THE USE OF A RADIO SET FOR BROADCASTING OF TIME SIGNALS FROM A CONTACT CHRONOMETER [ISPOL'ZOVANIE RADIOPRIYEMNIKA DLYA PERADACHI SEKUNDNYKH SIGNALOV KONTAKTNOGO KHRONOMETRA]

A. F. Ivanov *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 22–23 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

A method is described for the intensification of signals (seconds) of a contact chronometer by a radio set in order to broadcast them to the tracking place. Author

N65-23635 Academy of Sciences (USSR), Moscow. Astronomical Council

ON THE ACCURACY OF VISUAL TRACKING OF SATELLITES USING A SHUTTER [O TOCHNOSTI VIZUAL'NYKH NABLYUDENIY ISZ S PREMENENIYEM ZATVORA]

Z. S. Shilkina *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 23–25 ref In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

When a shutter placed between the TZK ocular and the eye is used for visual tracking, the accuracy of the position determination increases 3 to 5 times as compared with the usual tracking method. Author

N65-23636 Academy of Sciences (USSR), Moscow. Astronomical Council

ON THE RECEPTION OF TIME SIGNALS FOR PHOTOGRAPHIC OBSERVATIONS OF SATELLITES [O PRIYEME SIGNALOV VREMENI PRI FOTOGRAFICHESKIKH NABLYUDENIYAKH ISZ]

K. Lapushka *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 25–28 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

The possibility of receiving time signals on an electronic oscillograph with a printing chronograph without an impulse relay is discussed. It is a variety of the well-known phase changing unit. The scheme of connection and operation methods are described. Author

N65-23639 Academy of Sciences (USSR), Moscow. Astronomical Council

MULTIPLE TIMING FOR DETERMINING CORRECTIONS FOR THE ALTITUDE AND THE AZIMUTH OF A SATELLITE [MNOGOKRATNAYA ZASECHKA VREMENI DLYA OPREDELENIYA POPRAVOK VYSOTY I AZIMUTA SPUTNIKA]

V. A. Merkushev *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 32–34 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

A method for determining corrections to the observed azimuth (altitude) of a satellite introducing multiple timing and a special net of threads is described. Author

N65-23641# Martin Co., Baltimore, Md. RIAS Div.
INVESTIGATION OF FILTER FUNCTIONS Final Technical Report, 1 Jun. 1962–30 Sep. 1963
R. E. Kalman Jan. 1964 64 p refs
(Contract DA-36-034-ORD-3708Z)
(AD-430058)

The theoretical considerations of this work are based on the variational principle of adaptation. A large number of filters is examined simultaneously, each one of which is optimal for certain types of random signals. At each moment of time the output is taken from that filter which gives the smallest real-time error up to time t. In this way the unknown random process that generates the observed signal is identified indirectly. Experimental (digital computer) results are presented which confirm the logic of the principle. Two main conclusions may be drawn: (1) The new principle used allows unusually fast adaptation (within less than one-half time constant of the underlying dynamics), which was previously believed to be impossible. (2) The rate of computation per unit time necessary for such fast adaptation is extremely large. The total amount of computation is comparable to that required by conventional methods. Author

N65-23659# Gt. Brit. Dept. of Scientific and Industrial Research.
KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY PREDICTION SERVICE FROM EDINBURGH: APRIL AND MAY 1964
1965 17 p *Its* Issue 10

N65-23704*# Hughes Aircraft Co., Culver City, Calif. Space Systems Div.
FEASIBILITY STUDY PASSIVE LUNAR MARKER BEACON Final Report
26 Mar. 1965 97 p refs
(Contract NAS9-3980)
(NASA-CR-65004; SSD-5147R) CFSTI: HC $3.00/MF $0.75

Six general beacon configurations were examined: (1) a uniquely oriented single circular or triangular trihedral edge corner reflector; (2) four corner reflectors arranged as a hemisphere; (3) eight corner reflectors arranged as a sphere; (4) bird cage echo enhancer; (5) Van Atta array; and (6) biconical corner reflector. Each was modified by the addition of pigments or auxiliary optical beacons which provide a diffuse reflective surface for optical acquisition. The radar beacon design was the pacing item due to the difficulties encountered in satisfying the 20-nautical mile range and 12-dB signal to clutter ratio requirements. Further, the most severe constraint was providing a large enough radar target to compensate for cross section reduction when the beacon is viewed from a line of sight which varied from the reflectors axis of symmetry. This constraint is especially severe with the corner reflectors. The uniquely oriented beacon had the performance advantage of providing 100% coverage, being the overall lightest system, and was the recommended configuration. E.E.B.

N65-23758# Dewey (G. C.) Corp., New York.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF RADIATION ON THE PROPAGATION OF ELECTROMAGNETIC SIGNALS IN AIR Technical Report, 1 Dec. 1964–28 Feb. 1965
M. N. Hirsh, P. N. Eisner, and J. A. Slevin 28 Feb. 1965 34 p refs
(Contract DA-28-043-AMC-00457(E))
(R-190-2; AD-461654)

The extension of the steady-state oxygen model derived previously was extended to transient phenomena at low pressures. Also, the results of spectroscopic measurements in irradiated gas mixtures from scans over the wavelength region between 3000 and 6000 Å are reported and compared with previous values. These scans were made at a speed of 20 Å/min so that a single scan took about 2-1/2 hrs. Further, attempts were made to observe afterglow light from irradiated gases. The output of the photomultiplier was applied directly to an oscilloscope with a 1-Megohm input impedance. The Van de Graaff beam was pulsed periodically on for 15 msec, off for 10 msec. Measurements in pure N_2 at 5 and 12 torr failed to reveal any afterglow light from nitrogen band systems which decayed at least as slowly as 2 msec. The cyanogen bands, however, were observed to have afterglow lifetimes of the order of 1 sec at 12 torr. A series of scans was also made at a fixed nitrogen pressure of 8 torr over the range of oxygen pressures between 0 and 6 torr. As the oxygen pressure was increased, the intensities of all bands decreased. E.E.B.

N65-23771# Federal Aviation Agency, Atlantic City, N. J. Evaluation Div.
EVALUATION OF BEACON VIDEO DEFRUITING EQUIPMENT (STORAGE TUBE), TYPE FAA-R-1400 Final Report
Anthony D. Bradley Feb. 1965 40 p refs
(RD-65-18)

An evaluation of defruiting equipment (storage tube), was conducted to determine its effectiveness as a fruit eliminator. Stability of the defruiter performance and maintainability of the equipment were assessed. The defruiter was designed to eliminate a synchronous beacon video and to pass only the desired synchronous beacon video. Fruit-output rate measurements were taken over a range of simulated fruit-input conditions and compared to the anticipated fruit-output rate for each fruit-input condition. The evaluation included a 72-hour stability test as well as consideration of the various maintenance aspects of the equipment. It was concluded that the equipment is an effective fruit eliminator provided the delayed-video threshold controls are properly alined. It was also concluded that the defruiter is easily maintained and when properly alined and adjusted, operation is stable. Author

N65-23785* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RECENT DEVELOPMENTS IN ADAPTIVE TRACKING NOTCH FILTER TECHNIQUES
Michael T. Borelli, Stanley N. Carroll, and Hans H. Hosenthien *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 31–41 refs
(See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

Some recent advancements in the development and analysis of the adaptive tracking notch (ATN) filter are presented. The ATN filter was developed to help stabilize the structural bending signals encountered in the control loop of large aerospace vehicle boosters. First, an ATN filter that utilizes a simple differential amplifier is described, and its equivalence to the ATN filter that utilizes a chopper-stabilized operational amplifier is presented. Second, the presence of a quadrature component in the output signal of the ATN filter is shown to exist, and its effect on the notch characteristics is presented. A means of minimizing this effect is given along with a theoretical expression that approximately describes the magnitude of the inphase and quadrature components when the input and commutating frequencies are the same. Finally, an analytical expression for

the transfer function of the coupled ATN filter is presented, and its frequency response characteristics are discussed and compared to experimental data. Also, the relationship showing the dependence of the output harmonic frequencies of the ATN filter on the number of commutated capacitors employed and the respective phasing of the commutating functions is summarized. Author

N65-23792* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN UP-CONVERTER/DOWN-CONVERTER METHOD OF DATA TRANSMISSION

Edmund H. Gleason *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 87-91 (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

An up-converter–down-converter wideband microwave relay link is presented. The system involves converting vhf telemetry signals to microwave frequencies for transmission, and then converting them back to vhf at the receiving site for demodulation. Also discussed are the advantages and disadvantages of the system as compared to existing means of relaying telemetry data via microwave links. Author

N65-23845# Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.

AMRAD TELEMETRY SYSTEMS Final Report

William C. Kelly 15 Feb. 1965 29 p

(ARPA Order 198; Proj. Defender)

(RG-TR-65-1; AD-461693)

The primary features of the telemetry systems designed for AMRAD experiments 1, 3, 5, and 6 are described. Components for these systems were tested individually, and the assembled systems evaluated. Equipment used in connection with these systems and measurements required are discussed. Telemetry systems were designed for instrumenting the AMRAD interstage (three and one-half stage); feasibility tests made through the ground station indicate that the proposed system would adequately handle the interstage measurements. A detailed study was made of test procedures for the final assembly and launch areas. Author

N65-23880# Illinois Univ., Urbana. Radiolocation Research Lab.

SYNCHRONIZATION OF DIGITAL SYSTEMS BY MEANS OF A TRANSISTORIZED TRANSMITTER DISTRIBUTOR Technical Report No. 22

Richard A. Woerner 20 Jan. 1964 38 p refs

(Contract Nonr-1834(02))

(RRL Publ.-222; AD-430597)

A transistorized transmitter distributor, whose main function is to control the flow of data between teletype equipment and various digital systems, is described. When the data source and the receiver are not compatible, the transmitter distributor can convert serial data to parallel data and vice versa, and can synchronize the speed of data transmission between the devices. This intermediary is capable of transferring up to eight channels of parallel data when operating in direct parallel to parallel modes, or parallel to serial modes. Only five channels of data can be transmitted in the serial to parallel modes since the present teletype equipment transmits five data bits per word. Seven pairs of input/output devices are discussed. The logic circuits employed in the logic design, the methods for data conversion and synchronization, and flow charts of the system's operation, are presented. J.M.D.

N65-23942# Jasik Labs., Inc., Westbury, N. Y.

TELEMETERING ANTENNA SYSTEM, PHASE I AND TECHNICAL PROPOSAL FOR PHASE II Final Report

A. D. Bresler 3 Apr. 1964 103 p refs

(Contract AF 29(600)-4527)

(AD-455817)

Results of studies conducted under Phase I and a brief summary of technical proposals for Phase II, of the telemetering antenna system program, are presented. Data derived under Phase I are reported in the following areas: on-site propagation measurements, sledborne transmitting antenna studies, receiving antenna (collinear array) basic element studies, estimates of received signal levels as a function of array length and tower height, and design studies and cost analyses. Technical proposals for the receiving antenna, the transmitting antenna, the sledborne antenna, and the received signal level, are discussed. Results of propagation measurements conducted during Phase I are summarized. S.C.W.

N65-23947*# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.

RADIATION PATTERNS OF FOUR SYMMETRICALLY LOCATED SOURCES ON A PERFECTLY CONDUCTING SPHERE

Li-jen Du and C. T. Tai 15 Dec. 1964 43 p refs *Its* Rept.-1691-10

(Grant NsG-448)

(NASA-CR-62765)

The radiation patterns of four symmetrically located sources (dipoles or small apertures) on a perfectly conducting sphere are presented. Analytical solutions are given which were programed for the digital computer. The purpose is to get some idea of the radiation field of a symmetrical antenna system mounted on a satellite which may be considered as a sphere. The data contained in this report may serve as a guide in selecting certain desirable patterns which can be obtained by varying such factors as the size of the sphere and the number of the sources, their positions on the sphere, and their relative magnitudes and phases. Author

N65-23949# European Space Vehicle Launcher Development Organization, Paris (France).

A GENERAL SMOOTHING PROCEDURE FOR RADAR READINGS

E. Cambi Aug. 1964 10 p ref

(ELDO-TM-F-1)

A general rule is given for handling discrete radar data to deduce a smoothed value of some physical measurement hidden in noise. The rule applies to any possible type of autocorrelation function for noise. Explicit results are given for Markovian noise. Author

N65-23974# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

PCM TELEMETRY SYSTEM FOR SPACE VEHICLES "LABEN"

Pellegrini, Magri, and Bonani Nov. 1962 17 p

The instrumentation requirements and general design of the low level telemetry system are discussed. Considered were the following factors in the design of the instrumentation: (1) information efficiency; (2) telemetry system range; (3) transmission bandwidth; (4) required electrical power; (5) weight and volume; (6) reliability; (7) versatility; (8) accuracy; (9) data processing and storage; and (10) telecontrol capability. A block diagram is presented incorporating the fundamental parts of the system for the recovery of spaceborne

data by multichannel instrumentation. They are a solid-state low level commutator for analog inputs; a normalizing commutator and amplifier; an analog-to-digital converter; a temporary memory unit; a frequency-analog sensor unit; a programing unit; a record station, and quick-look facilities. G.G.

N65-24008# Advanced Development Labs., Inc., Nashua, N. H. Microwave Dept.
RESEARCH ON ELECTROMAGNETIC COMPATIBILITY TECHNIQUES Interim Engineering Report, 1 Jul.–1 Dec. 1964
B. L. Geddry [1964] 78 p
(Contract AF 33(615)-2076)
(IER-1; AD-461732)

A solid-state diode switch assembly capable of connecting a receiver to any one of the eight array beam ports is complete and undergoing tests. Provision for connecting a load to the unused beam ports is included in the switching assembly. A scan box was designed and built, which provides scan rates from 1 c/sec to 200 Kc/sec. Manual switching provisions are also incorporated. Data obtained thus far on the individual units indicate good system performance. Author

N65-24048# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Energia Nucleare
TECHNICAL SPECIFICATIONS OF THE CONTROL STATION FOR PCM TELEMETRY SYSTEM
C. Pellegrini, Magri, and Bonani Jun. 1963 6 p

General and technical specifications of the control station for the PCM telemetry system are presented. The control station allows immediate digital and analog calculation of three arbitrarily chosen channels and commutables during experimental testing of the PCM system. For each channel, the order of commutation and subcommutation can be fixed depending on the requirements of the telemetry system being tested. The principal parts of the station include a synchronizer, pin board, BCD converter, and output registers. A description of each component is included. S.C.W.

N65-24049# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
TECHNICAL SPECIFICATIONS OF AIRBORNE PCM TELEMETRY SYSTEM
Pellegrini, Magri, and Bonani Jun. 1963 8 p

General and technical specifications for the low-level PCM telemetry system are presented. The system is designed to handle three different variables which include analog signals, frequency analog signals, and digital signals. The system can handle up to 128 prime channels, but the number of variables and the sampling rate can range widely with subcommutation and supercommutation techniques. A brief description of the design objectives of the modular assembly and the unit of the PCM system is included. The following technical specifications are described: the central timer, sequence and format programer, low- and high-level multiplexer, normalization unit, analog to digital converter, temporary memory registers, frame and subframe synchronization, and output mixer. Input and output characteristics, and environments and test conditions are also discussed. A block diagram of the system is included. S.C.W.

N65-24085# Washington Univ., Seattle. Coll. of Engineering
A CLASS OF EQUIANGULAR SPIRAL ANTENNAS EXCITED BY A VERTICAL DIPOLE Technical Report No. 92
Gary D. Bernard and Akira Ishimaru Dec. 1964 127 p refs
(Contract AF 19(628)-2763)
(AFCRL-65-62; AD-460592)

A spiral plane containing many spiral tapes or arms, but excited by a vertical dipole is discussed. Eight distinct theoretical problems are investigated, each involving the spiral plane excited by a vertical dipole, but in different surrounding geometry. All the problems are formulated in terms of Fourier-Bessel transforms of electric and magnetic Hertz potentials, yielding exact solutions in integral form. Quantities of interest such as far zone fields, current distributions in the spiral plane, and modal solution excitation are found using the integral forms of the potentials, and are discussed in detail. In the experimental study a very broadband, endfire, unidirectional, linearly polarized, high gain antenna was developed. There is an exact theory for this antenna and for related antenna problems. Author

N65-24120# Library of Congress, Washington, D. C. Aerospace Technology Div.
PROPAGATION FUNCTION AND MEAN PHASE VELOCITY OF ELECTROMAGNETIC WAVES AT ULTRALOW FREQUENCIES [FUNKTSIYA RASPROSTRANENIYA I SREDNYAYA FAZOVAYA SKOROST' ELEKTROMAGNITNYKH VOLN NA SVERKHNIZKIKH CHASTOTAKH]
A. G. Mikhaylova 30 Apr. 1965 7 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 5, no. 1, 1965 p 183–186
(ATD-T-65-21; AD-462424) CFSTI: HC $1.00/MF $0.50

A comparative study of daytime and nighttime atmospheric spectra and mean phase velocities of electromagnetic wave propagation near the earth's surface is presented. Emphasized are results of nighttime investigations. The shape of nighttime signals was found to be as varied as daytime signals. It was observed that 78% of nighttime signals were attenuating signals of oscillatory shape with superimposed hf signals. In 30%, the atmospheric spectra were accompanied by a hf component or tail. At night, tail amplitude reception was relatively high even from distances of 4000 to 5000 km. A harmonic analysis of oscillatory shaped signals transmitted from the west and southwest of the point of observation at distances of 1000 to 4000 km from the source, is presented. Among the conclusions drawn were that the spread of amplitude spectra of single signals is larger at night than during the day, and mean phase velocities were similar for both daytime and nighttime observations. S.C.W.

N65-24122# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
THE AERODISCONE ANTENNA
Normand Barbano 25 Apr. 1965 34 p refs
(Contract DA-36-039-AMC-03214(E))
(EDL-M672; AD-472135)

The aerodiscone antenna is an electrically small structure suitable for airborne applications, particularly the vhf and uhf bands. It is derived from and preserves the desirable electrical characteristics of the discone antenna and can be designed to have various physical configurations. The antenna is capacitively top-loaded and pin loaded in the aperture to achieve small electrical size. The primary function of pin loading is to increase the input resistance of the antenna at the low end of its frequency range to maintain a high radiation efficiency. Author

N65-24151 Joint Publications Research Service, Washington, D. C.
THE EFFECT OF COHERENT AM INTERFERENCE ON THE ACCURACY OF RANGE MEASUREMENT BY A PHASE RANGE-FINDING RADAR

P. M. Golubev *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 1-4 ref (See N65-24150 13-09) CFSTI: $6.00

The effect of coherent amplitude-modulated interference on the accuracy of a phase range-finding radar is considered, with measurement of the phase difference at the modulation frequency. The calculated values of the signal/noise ratio, needed to provide the given accuracy are provided. Author

N65-24196# Radiation Systems, Inc., Alexandria, Va.
INVESTIGATION OF A MULTIPLE BEAM SCANNING CIRCULAR ARRAY Final Report
George G. Chadwick and John C. Glass 13 Apr. 1964 123 p refs
(Contract AF 19(628)-367)
(AD-614288)

The theoretical and experimental efforts expended in the investigation and analysis of the multibeam cylindrical array concept proved that the fundamental concept was plausible and practical. Also, the results achieved with the 4-element and 16-element fixed frequency multiple-beam arrays were in general accord with the predicted data. The 4 × 8 multiple-beam cylindrical array attested to the fact that multiple beams can be formed at a number of elevation stations simultaneously. Further, the broad bandwidth experiment showed that beams could be formed over an octave in frequency range. A general design procedure for achieving a given level of performance with the cylindrical array is included. E.E.B.

N65-24200# Army Electronics Labs., Fort Monmouth, N. J. Communications Dept.
TESTING OF DIGITAL DATA TRANSMISSION SYSTEMS
James E. Bartow Feb. 1965 80 p refs
(ECOM-2558; AD-614775)

This report describes tests performed on various communication systems to determine their capability to pass digital data. A collection of test results from many sources has been gathered. Experiments on hf, vhf, uhf and shf radios, and on cable and wire systems, etc., are included. Preliminary results of several experimental programs which have not been published previously are presented. An analysis of the data is made. The significance of the results in terms of specifying and designing a communication channel to optimize its interoperation with a data processing system is explained. An outline is presented of further tests required to determine basic communication limitations, to discover causes of digital errors, and to verify specific data/communication system performance. Author

N65-24225# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.
DESIGN AND THEORETICAL PERFORMANCE OF REACTIVE-WALL CORNER REFLECTORS Technical Final Report
E. M. Kennaugh and C. Chung 13 Jan. 1965 26 p refs
(Contract NOw-64-0215-d)
(Rept.-1790-1; AD-458004)

Discussed are the design of multilayer dielectric coatings for an operating wavelength of 9 mm, and reactive-wall modifications to a single face of a triple-bounce corner reflector to obtain a large percentage of the reflected signal power in the same-sense mode. It was concluded that it is possible to obtain adequate same-sense circularly polarized responses from conventional triple-bounce corner reflectors by modifying a single wall. Minor reductions in coverage in one plane can be overcome by proper mounting of the reflector to eliminate any loss of performance. G.G.

N65-24309*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TELEMETRY TEST SYSTEM
Wallace Goode and Anthony Buige Mar. 1965 12 p
(NASA-TM-X-55215; X-536-65-127) CFSTI: HC $1.00/MF $0.50

A prototype Telemetry Test System designed to meet the need for rapid checkout techniques to insure the functional operability of the STADAN telemetry system at any given time is described. The system consists of four subsystems (generator, telemetry receiver, up-down or upcounter, and bit counter), each of which is designed to operate under two general modes, ring or pseudorandom. The use of the system to formulate the bit error curve of a telemetry signal conditioner, to evaluate telemetry ground transmission links and STADAN equipment, and to conduct flyby tests at STADAN sites is exemplified. S.C.W.

N65-24310*# Stanford Univ., Calif. Radioscience Lab.
BISTATIC-RADAR METHODS FOR STUDYING PLANETARY IONOSPHERES AND SURFACES Scientific Report No. 2 (Final)
Gunnar Fjeldbo Apr. 1964 95 p refs
(Grants NsG-377; NSF G-21543)
(NASA-CR-62823; SEL-64-025) CFSTI: HC $3.00/MF $0.75

The transmission of radio waves from the earth to a receiver in a spacecraft that is moving behind a planet makes it possible to observe the variations in the amplitude, phase path, or group path caused by the planetary ionosphere. It is shown that measurement of any one of these quantities may be used to determine the radial electron density distribution in that part of the planetary ionosphere which is probed by the signal. Measurement of two of these quantities simultaneously will reduce uncertainties due to changes in the interplanetary medium or the earth's ionosphere during the experiment. Separate radial electron density distributions can be obtained from the measurements during immersion and emersion and these are related to the spatial properties of the atmosphere on the planet. It is shown that the lower atmosphere as well as the ionosphere of a planet can be studied by using so high a frequency that the signal is not influenced by the ionized component of the atmosphere. Author

N65-24366# Dayton Univ., Ohio. Research Inst.
SMALL SCALE WIND SHEARS FROM ROSE BALLOON TRACKED BY AN/FPS 16 RADAR Final Report
William E. Brockman Dec. 1964 98 p refs
(Contract AF 19(604)-7450)
(AFCRL-65-99; AD-613539)

This radar system is designed to report small-scale winds and shears by polynomial smoothing of the radar tracking data. The most successful mathematical technique for fitting the data and computing winds and shears is presented along with other techniques considered. Analysis of the self-induced balloon motion is attempted by classical physical methods and by a power spectral density technique. A criterion for evaluating the effect of modification to the standard ROSE is developed and applied to a modified ROSE and the newer small lightweight balloon. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 99 Mathematics.

N65-23525 European Organization for Nuclear Research, Geneva (Switzerland).
A DATA LINK FROM PS EXPERIMENTAL AREA TO MERCURY COMPUTER
F. Marciano and H. J. Slettenhaar 4 Feb. 1965 28 p refs (CERN-65-5)

A data link which was connected to an experimental system known as the missing-mass spectrometer, consisting of sonic spark chamber and scintillation counter hodoscopes, is described. Also, the multicore cable link; the multichannel computer input/output facilities; subcodes; program loop from scalers and hand-keys; data link transmitter–receiver circuitry; input/output selection circuitry; and the equipment connected to the data link are discussed. E.E.B.

N65-23746# Joint Publications Research Service, Washington, D. C.
THE SPECIALIZED ELECTRONIC COMPUTER "OCEAN"
V. P. Vanin, L. I. Galerkin, and Yu. K. Chervychnik 12 May 1965 46 p Transl. into ENGLISH from Tr. Inst. Okeanol. (Moscow), v. 75, 1964 p 99–131.
(JPRS-30034; TT-65-30974) CFSTI: $2.00

The "Ocean" computer is a specialized electronic apparatus for mass computations in processing temperature and salinity data from deep oceanographic stations. The computer solves 18 tasks. The given values of temperature, salinity, and depth of observations are interpolated for standard bekels for computing density, specific volume, temperature, salinity and density gradients, vertical heat content, dynamic depths, and sound velocity. Water density and specific volume are calculated in two ways: using the observed values and by Ekman's formula taking into account the compressibility factor. The keyboard device is used for data input without preliminary punching. The output has the form of figures printed on a paper tape 45-cm wide. Processing of one station with 20 levels observed occupies 20 to 25 minutes. The computer operator's labor efficiency is 30 to 40 times as great as that of the existing manual processing. The electronic circuit of the computer is assembled on cold cathode tubes which increase the reliability and service life of the electronic devices. Principal diagrams of separate blocks are presented, as well as the description of logic and arithmetical and control units.
Author

N65-23782* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INTRODUCTION TO THE KALMAN-SCHMIDT FILTER
John W. Kenelly and Kenneth S. Williamsom *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 1–8 refs (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

This article provides an insight into the application of the Kalman–Schmidt filter to navigation for technical personnel with limited background in probability theory. The statistical derivation of the Kalman–Schmidt filter is included within the context of space-flight navigation. The filter may be used to locate a space vehicle, and to determine its velocity vector from data containing random errors. The filter is superior to least squares because each observation datum does not have to determine the position of the vehicle. Author

N65-23882# Massachusetts Inst. of Tech., Cambridge.
NATURAL LANGUAGE INPUT FOR A COMPUTER SOLVING SYSTEM
Daniel G. Bobrow (Ph.D. Thesis) Sep. 1964 129 p refs (Contract Nonr-4102(01); Proj. Mac)
(MAC-TR-1; AD-604730)

The STUDENT problem solving system, programed in LISP, accepts as input a comfortable but restricted subset of English which can express a wide variety of algebra story problems and solves a large class of these problems. The STUDENT can utilize a store of global information not specific to any one problem, and may make assumptions about the interpretation of ambiguities in the wording of the problem being solved. If it uses such information, or makes any assumptions, STUDENT communicates this fact to the user. Other English language question–answering systems are summarized; these systems, and STUDENT, are evaluated according to four standard criteria. The linguistic analysis in STUDENT is a first approximation to the analytic portion of a semantic theory of discourse. The STUDENT system is a first step toward natural language communication with computers. Author

N65-23884# Bettis Atomic Power Lab., Pittsburgh, Pa.
MO564, A FORTRAN PROGRAM FOR SYMMETRIC AND ASYMMETRIC RESONANCE INTEGRALS
D. R. Harris and G. J. Peters Nov. 1964 15 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-494) CFSTI: $1.00

A description is given of the Fortran program, MO564, designed for use on the Philco 2000 computer. The program computes the infinite dilution resonance integral, and the sum for a group of resonances, when the cross section for each resonance is represented by a single level Breit–Wigner formula. The calculation is carried out in two approximations referred to as symmetric and asymmetric corresponding to noninclusion or inclusion of a lower energy cutoff and the $E^{-1/2}$ factor in the single level formula. The ratio of asymmetric to symmetric resonance integrals is plotted for practical ranges of resonance parameters and energy cutoff. Author

N65-24020*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
MONTE CARLO PERFORMANCE ANALYSIS COMPUTER PROGRAM WITH PROGRAMMED MIXTURE RATIO
Roy C. Lester 22 Mar. 1965 110 p refs
(NASA-TM-X-53222) CFSTI: HC $4.00/MF $0.75

This report presents a detailed description of a Fortran IV program which uses the Monte Carlo technique to establish the stage residual and a total payload distribution for a vehicle with up to 10 stages. The Monte Carlo technique employs the sampling of the independent engine and vehicle parameters, and, by the use of a large number of cases, is used to establish the probability distribution for stage residual and total payload. Author

N65-24150 Joint Publications Research Service, Washington, D. C.
COMPARATIVE EVALUATION OF SEVERAL METHODS OF CONVERSION OF A SINGLE ELECTRICAL SIGNAL INTO A SERIES OF DISCRETE VALUES
N. M. Funtov, G. V. Smirnov, Ye. A. Petrov, and Yu. M. Osipov *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 66–76 ref (See N65-24150 13-09) CFSTI: $6.00

Expressions for the error based on the discreteness of the conversion are cited. By means of the error analysis, permissible lengths of the single-signal are established, taking into account their dynamic range. The most rational methods of conversion are shown. Author

N65-24162 Joint Publications Research Service, Washington, D. C.
MAGNETIC PULSE DECODER FOR THE BPM-20 CONTROL ARRANGEMENT
N. Ya. Yarmosh and V. K. Goncharova *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 84–94 refs (See N65-24150 13-09) CFSTI: $6.00

A new magnetic decoder based on the principle of utilizing the nonideal square hysteresis loop of cores is described. An arrangement is shown for using this decoder with ferrite cores, with PPG (square hysteresis loop). The possibility of its application in devices of TsVM (digital computers) is shown. Author

N65-24164 Joint Publications Research Service, Washington, D. C.
TWO-CHANNEL INPUT INFORMATION SYSTEM FOR THE "URAL-1" FOR COMPUTING THE CORRELATION RELATIONSHIPS BETWEEN EMPIRICAL SEQUENCES
L. V. Chernysheva *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 100–108 refs (See N65-24150 13-09) CFSTI: $6.00

A system is described for information input recorded on a magnetic tape in the form of a pulse sequence randomly distributed with respect to time, for the Ural-1 computer. A block diagram for the system is given. The special features of programing when processing information are considered. Author

N65-24165 Joint Publications Research Service, Washington, D. C.
AN ADDER USING AMPLITUDE CODING OF BIT WEIGHTS IN THE THROUGH-CARRY CIRCUIT
Yu. P. Rudnev *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 109–120 ref (See N65-24150 13-09) CFSTI: $6.00

This article considers the use of amplitude coding in the through-carry circuit of a binary adder in order to reduce the number of serially connected components, which is realized by means of adders for the summation of voltages across resistances. An evaluation is made of the speed of operation of an accumulator adder using this principle. Author

N65-24166 Joint Publications Research Service, Washington, D. C.
DECIMAL ACCUMULATOR ADDER WITHOUT CARRY PROPAGATION
N. N. Posnov *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 121–132 refs (See N65-24150 13-09) CFSTI: $6.00

The possibility of building an accumulator adder, operating in the decimal system, is considered. The circuit of a two-register adder which accomplishes addition and subtraction is given. Author

N65-24192# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INVESTIGATION OF THE THEORY OF ALGORITHMS WITH EMPHASIS ON PROGRAM SIMPLIFICATION Final Report, Dec. 1963–Feb. 1965
David C. Luckham 15 Feb. 1965 35 p refs *Its* Rept.-1225
(Contract AF 19(628)-3995)
(AFCRL-65-170; AD-614287)

This report develops further the theory of program schemes previously studied by Ianov and by Luckham, Park and Marill. The aim is to provide general insight into computer program problems, especially optimization. New results are given, and techniques for finding removable parts of program schemes and for shortening loops are discussed. Author

N65-24201# California Univ., Berkeley. Operations Research Center
UPDATING THE PRODUCT FORM OF THE INVERSE FOR THE REVERSED SIMPLEX METHOD
George B. Dantzig, R. P. Harvey, and R. D. Mc Knight (Standard Oil Co.) Dec. 1964 13 p
(Contract Nonr-222(83))
(ORC-64-33; AD-614576)

A method is proposed by which the number of transformation matrices in the product form of the inverse for the revised simplex method of solution of linear programs need never exceed m, the number of rows. The chief advantage of this proposal is that the number of nonzeros in the inverse representation is conserved and remains approximately constant after the initial buildup. Before giving a description of the algorithm, which is oriented toward a computer code adaption, an example was considered which shows the original array, a motion picture of the step-by-step procedures, and finally the updated array. E.E.B.

N65-24202# California Univ., Berkeley. Operations Research Center
PROGRAMMING IN NETWORKS AND GRAPHS
Ellis Johnson Jan. 1965 63 p refs
(Contract Nonr-222(83); Grant NSF GP-2633)
(ORC-65-1; AD-614578)

A certain class of linear programs, the corresponding graphical interpretation, and the bringing together of the graphical and the algebraic approaches are discussed. Also, the simplex method for solution of the network flow problem is presented. A descriptive outline is given as a structure on which algorithms are built. The simplex algorithm began with a feasible basis and nonbasic variables at upper or lower bounds. A distribution problem is used as an illustrative example. Also, the max-flow algorithm is considered which has these advantages over the network linear programing algorithm: simplicity in determining dual variables, pricing out, and at most m iterations in sequence it can occur with no change in flow. The primal-dual method for network flows is treated. Flows with gains, linear and integer programing in an undirected graph, and the degree-constrained subgraph problem are covered. E.E.B.

N65-24203# California Univ., Berkeley. Operations Research Center
OPERATIONS RESEARCH IN THE WORLD OF TODAY AND TOMORROW
George B. Dantzig Jan. 1965 12 p
(Contracts Nonr-222(83); Nonr-3656(02); Grant NSF GP-2633)
(ORC-65-7; AD-614579)

The developments in recent years of the electronic computer and mathematics, and their penetration into almost every phase of human activity is discussed. Also, operations research and cybernetics, the science of control, are reviewed. It is observed that cybernetics, in a broad sense, is operations research. Further, the sense of urgency and the priority given to the subject of cybernetics by the Soviet Union is considered. E.E.B.

N65-24216# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DATA SYSTEMS Quarterly Progress Report, Division 2, 1 Nov. 1964–31 Jan. 1965

F. C. Frick and S. H. Dodd 12 Mar. 1965 20 p refs
(Contract AF 19(628)-500)
(ESD-TDR-65-47; AD-612541)

Continued research is reported in the following areas: digital computers, computer components, psychology, and control research. Data are included on computer systems, circuit development, magnetic film engineering, system programing and applications, magnetic films, electron transport, automatic procedure executors, human information processes, hybrid computer systems, and estimation and control studies. S.C.W.

N65-24239# Iowa State Univ. of Science and Technology, Ames. Ames Lab.

GENERATION AND TESTING OF RANDOM NUMBER SEQUENCES

Frank S. Carlsen Mar. 1965 39 p refs
(Contract W-7405-ENG-82)
(IS-1128) CFSTI: $2.00

Two methods of generating pseudorandom numbers in a decimal computer are described. Methods of testing the sequences of generated numbers are discussed, and the two methods of generation are compared to determine which method is superior for general usage. A computer routine to generate both uniformly and normally distributed numbers is presented, with a table of 9000 three-digit numbers uniformly distributed on the unit (0-1) interval. Author

N65-24241# California Univ., Livermore. Lawrence Radiation Lab.

ESTIMATION OF COUNTING RATES FROM PERIODIC OBSERVATIONS OF A SMALL SET OF BINARY SCALERS

J. Stevens 25 Mar. 1965 18 p
(Contract W-7405-ENG-48)
(UCRL-7798) CFSTI: $1.00

The counts received by a radiation detector located on a space satellite were stored in a small set of binary scalers. The number of counts stored in these scalers was read out once per second for eventual transmission to earth via telemetry. This information was then used to determine counting rates as a function of location in space. The number of scalers used was too small to contain all the counts which could be received during the time interval between successive samplings of the scaler contents. This posed the problem of estimating the probability that the scalers had been filled, had automatically reset to zero, and had begun storing counts again during the interval between samplings. Because of telemetry limitations it was not possible to sample the condition of all the binary scalers. Only the information stored in the last few scalers is known, and hence there is the problem of estimating how many counts are stored in the preceding scalers. A technique for analysis of the data is presented, together with flow charts for a Fortran code using this technique. Author

N65-24258# Autonetics, Anaheim, Calif. Navigation Systems Div.

MECHANIZATION OF SST INERTIAL NAVIGATION COMPUTATIONS IN AN ALL-DDA COPUTER

M. F. Sentovich Jun. 1964 36 p Presented to the Inst. of Navigation, New York, 15–17 Jun. 1964

An all-DDA computer is chosen for mechanization of SST inertial navigation equations to help make the cost of the inertial system more competitive. The ease with which the DDA handles dead-reckoning navigation is discussed, but attention is focused on the operations required for initialization, computation of display and control functions, and timing and switching. Techniques are presented for improving effective resolution of computations when computer scaling is coarse. Author

N65-24284# European Atomic Energy Community, Brussels (Belgium).

STUDIES OF MAGNETIC TAPE INSTRUMENTATION FOR ON-LINE RECORDING AND OFF-LINE ANALYSIS OF DATA FROM MULTIPARAMETER NUCLEAR EXPERIMENTS

B. Idzerda Feb. 1965 20 p refs
(EUR-2119.e) Available from Belg. Am. Bank and Trust Co., N. Y., Account No. 22.186: 40 Belg. Fr.

A 4-track, 1/4-inch magnetic tape was used as a storage medium for 8-bit words in the series parallel mode. Stepwise tape transport by means of a stepping motor was applied in order to get high bit-packing densities at low data rates. For higher rates, the use of the original continuous speeds is still possible. The studies of stepping techniques have shown that stepping motors with the smallest stepping angle allow the highest packing density (i.e., 250 bits per inch.) A simple test of the realized unit shows a failure rate of 1.5%. Experiences gained from these preliminary studies were used for the modification of a 1-inch, 24-track tape deck. First measurements have shown that the realization of the following specifications may be expected: a bit density of 250 bits per inch at stepping with a simple switch-over facility to continuous speeds. Author

N65-24335# European Atomic Energy Community, Brussels (Belgium).

EU. GRAPH: A GENERAL FORTRAN-FAP SUBROUTINE FOR THE POINT PLOTTING OF CURVES

C. Mongini-Tamagnini and J. Pire Jan. 1965 33 p refs
(EUR-2238.e) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 60 Belg. Fr.

A Fortran-Fap subroutine, for the point-plot of up to three curves, is described. Scaling both in abscissa and in ordinate is automatically done by the subroutine, and labels are printed for its interpretation. Some comparisons, carried on between EU. GRAPH and a continuous data plotter (Calcomp type), show the advantages that, in many cases, a point-plot subroutine can present. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N65-23428 National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.

SPHERE GAP VOLT–TIME CURVES

F. C. Creed *In its* Bull. of the Radio and Elec. Engr. Div., Vol. 14, No. 4, Oct.–Dec. 1964 Dec. 1964 p 8–14 refs (See N65-23425 13-07)

The voltage–time curve for a 60-mm gap between 250-mm spheres was determined. The impulses used in the test were recorded with a cathode-ray oscillograph in conjunction with a voltage divider connected across the test gap. The connection between the voltage divider and the test gap consisted of a lead about 7 ft long, with a damping resistor inserted at the test gap end. Two different values of damping resistance were used so that, in effect, two complete voltage–time curves were determined, one with each measuring system. The reason

for this procedure was the uncertainity of the accuracy of either measuring system. The step responses of both systems as determined with a compressed-gas gap did not give a true picture of the behavior of either measuring system. This was because the step response was measured with the start of the divider lead very close to ground, whereas when the divider was used for measurements the lead was about 7 ft above the ground plane. The system with the larger damping resistance of 470 ohms had a positive response time, whereas the other one with a resistance of 287 ohms possible had a negative one. It is expected that the true voltage–time curve lies somewhere between the two curves obtained. Therefore, it was concluded that the use of the two systems probably brackets the correct values. E.E.B.

N65-23592# Lenkurt Electric Co., Inc., San Carlos, Calif.
NETWORK, HYBRID BRANCHING. PHASE A: TW-618 (XW-1)/FCC-17 AND TA-640(XW-1)/FCC-17 THROUGH TA-644(XW-1)/FCC-17
Forrest N. Easley and Terry R. Holmes Griffiss AFB, N. Y., RADC, 30 Oct. 1964 37 p refs
(Contract AF 30(635)-11188)
(RADC-TDR-64-372, Vol. I; AD-462045)

A chronological summary of design and development problems and a detailed theoretical discussion of the hybrid branching network are given. The hybrid branching network was designed and developed for insertion in a radio baseband to allow supergroups or groups of vf channels to be dropped from the baseband and be routed to multiplex terminal equipment. The remainder of the vf channels stay in the baseband as through channels. Any channels dropped may be replaced by new ones covering the same frequency range. Difficulty was encountered in designing a high-pass filter circuit to operate within specified limits at 108 and 156 kc with a narrow transition interval between the stopband and the passband. This problem was solved by inserting a Q multiplier in the high-pass filter circuit. The predicted mean-time-between-failure (MTBF) of each hybrid branching network is 7700 hours and the point availability (PA) is 99.9967%. Author

N65-23665# Michigan Univ., Ann Arbor. Electron Physics Lab.
INVESTIGATION OF LARGE-SIGNAL TRAVELING-WAVE TUBES Final Report
G. T. Konrad and J. E. Rowe Griffiss AFB, N. Y., RADC, Feb. 1965 100 p refs
(Contract AF 30(602)-2834)
(RADC-TR-64-542; AD-459592)

A two-dimensional nonlinear analysis for large-signal phenomena in klystrons and traveling-wave tubes is employed to analyze several special cases. These are traveling-wave interactions with electron streams in finite axial magnetic fields, hollow-beam TWA interactions, biased-gap klystrons, and distributed interaction klystrons. A nonlinear theory employing the density function method is developed. Thermal velocities in a beam-circuit system are directly accounted for in this approach. The phase-focusing studies on helix-type tubes yielded several conclusions. The percentage taper for maximum efficiency improvement in helix-type TWA's appears to be approximately 50% while the actual form of the taper is not extremely critical. Efficiency enhancements as high as 1.5 times can be readily achieved by these techniques. The work done on a ring-and-bar tube is described. The tube behaved normally. Digital computer programs to handle most axially symmetric guns and beams are described. Special programs for relativistic beams, gridded guns, and magnetron injection guns are described in detail. The noise studies on high-power beams consist of noise reduction mechanisms in beating-wave operation and preliminary work on a low-noise system employing a magnetron injection gun. The construction and refinements of the gun are described and results outlined. Author

N65-23694*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROPOWER LOGIC CIRCUITS
John C. Sturman Washington, NASA, May 1965 21 p
(NASA-SP-5022) CFSTI: HC $0.75/MF $0.50

A description is presented for digital logic circuits developed for very low power logic systems in space vehicles which can be advantageously adapted for specific applications in nonspace computer systems. The circuits described include the conventional transistor inverter, basic complementary transistor invertor, reset-set flip-flop, complementary toggle flip-flop, basic similar-transistor inverter, transistor input NOR, and the similar-transistor monostable multivibrator circuits. Also, the packaging of units of high density is discussed. Further, the single-pulse generator, multiple-input trigger, and the dual-voltage power supply circuits are included. Characteristics and advantages of these circuits are discussed. E.E.B.

N65-23765# General Electric Co., Auburn, N. Y. Rectifier Components Dept.
RESEARCH AND DEVELOPMENT OF HIGH CURRENT AND HIGH VOLTAGE SILICON CONTROLLED RECTIFIERS Final Report, 30 Jun. 1962–31 Dec. 1963
J. F. Essom et al [1964] 112 p refs
(Contract NOBsr-87648)
(AD-430901) CFSTI: $2.50

This report covers research and development to obtain high-current, high-voltage silicon controlled rectifiers. Their design, development, optimization, fabrication and characterization are described and discussed in detail, along with a description of process steps and component parts. Author

N65-23814*# Little (Arthur D.), Inc., Cambridge, Mass.
AN EXAMINATION OF THE APPLICABILITY OF MICROELECTRONIC CIRCUITS TO THE TELEMETRY AND COMMAND SUBSYSTEMS OF SEVERAL APPLICATIONS SPACECRAFT
Washington, NASA, May 1965 146 p refs
(Contract NASw-732)
(NASA-CR-223) CFSTI: HC $5.00/MF $1.00

An analysis is presented which shows that available silicon integrated circuits have a number of advantages. Integrated circuits are available with power consumptions as low as most discrete circuits, although the power drain is not as low as that achievable with best low-power transistors. Thus, there is no direct power advantage in using integrated circuits, but there are substantial weight and size advantages to balance the additional power supply weight required. Further, direct substitution of circuits in the digital portions of subsystems is a relatively straightforward procedure, requiring only a moderate redesign of most circuits. Also, the radiation tolerance of silicon integrated circuits is theoretically similar to that of circuits made up with discrete components. In practice, small size of most integrated active devices may advantageously offset the much larger number of transistors used in integrated circuits. E.E.B.

N65-23851# Japan Broadcasting Corp., Tokyo. Technical Research Labs.
LINE-SEQUENTIAL CHROMINANCE COMPONENTS TRANSMISSION SYSTEM IN COLOR TELEVISION AND ITS APPLICATION
Minoru Inatsu Jan. 1965 33 p refs *Its* Technical Monograph No. 4

This report describes the experimentally confirmed result that the picture quality deterioration is less in the LSCC system than in the NTSC system, because of the line structure of the television picture and the characteristics of human vision for colored images. The characteristics of the signal reproduced through NTSC-LSCC-NTSC conversions and the effects of deterioration of the LSCC signal transmission path on picture quality are discussed. A description is given of the NTSC⇌LSCC signal converters which were developed for the practical application of the LSCC signal transmission techniques. Color video tape recording is considered as an example of application. It is shown that the pictures reproduced from the LSCC recording are better by far than those from the NTSC recording, if the subcarrier beat interference, a problem also present in the NTSC direct recording, is removed by the improvement of the modulator and demodulator, and that the color picture quality deterioration in the video tape recording is considerably decreased owing to the superiority of the LSCC signal. Author

N65-23863# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati
THE DEFLECTOR OF ADONE: STUDY AND DESIGN [IL DEFLETTORE DI ADONE: STUDI E PROGETTO]
A. Massarotti, M. Puglisi, and F. Tazzioli Dec. 1964 34 p refs *Its* Nota Interna No. 275 In ITALIAN
(LNF-64/68)

Design characteristics of the deflectors or baffle plates, resonant cavities, quadrupoles and injection optics for the storage ring of the Adone particle accelerator are discussed. Transl. by P.F.E.

N65-23890# Litton Industries, San Carlos, Calif. Electron Tube Div.
HIGH VACUUM MODULATOR TUBE STUDY Final Report, Apr. 1, 1961–Dec. 15, 1963
Lowell J. Fox [1963] 68 p refs
(Contracts DA-36-039-SC-87361; DA-36-039-AMC-00153(E)) (AD-456545)

The feasibility of developing a switch tube capable of operating at the 350-kilovolt level was studied. Four L-3620 magnetron injection gun switch tubes were constructed and tested to voltage levels in excess of 300 kilovolts. The magnetic field was found important in the high-voltage stability of the L-3620 so the area of magnetics is discussed in its relation to the other principle areas of study. In the electron gun area, an empirical design procedure is discussed and the gun characteristics are given along with the critical dimensions of the magnetron injection gun used in the L-3620. The high voltage discussion is concerned with the voltage gradients between the mod-anode and collector both from a gross gradient standpoint between electrodes and from a local gradient standpoint at the negative electrode in the high-voltage region. A crossed field instability of the Penning discharge-type is discussed along with magnetic field configurations which were determined to suppress this discharge. Author

N65-24044# General Electric Co., Cincinnati, Ohio.
STATIC SWITCHING PROGRAM Final Report
21 Apr. 1965 29 p refs
(Contract AT(40-1)-2847)
(GEMP-300) CFSTI: $2.00

This report describes an approach to a reactor scram bus which utilizes all solid-state components except for the transition from electrical energy to mechanical energy to drive actuators. Controlled rectifiers are used in place of relays. Transistors are used in place of vacuum tubes. Unitunnel diodes are used as the signal level detecting devices. Author

N65-24150# Joint Publications Research Service Washington, D. C.
IZVESTIYA VUZov: Instrument Building, Vol. VIII, No. 1, 1965
17 May 1965 249 p refs Transl. into ENGLISH of Izv. Vysshikh Uchebn. Zavedenii, Priborostr. (Leningrad), v. 8, no. 1, Jan.–Feb. 1965 p 3–191
(JPRS-30110; TT-65-31005) CFSTI: $6.00

Electronic instrumentation and construction of instruments and components are reviewed. For individual titles see N65-24151–N65-24181

N65-24152 Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF THE PASSAGE OF PULSED SIGNALS THROUGH AN ELECTRONIC SWITCH
A. S. Mkrtchyan *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 5–12 (See N65-24150 13-09) CFSTI: $6.00

Distortions originating in the passage of electric pulses through an electronic key are considered. For the equivalent circuit of an electronic key, a theoretical investigation was performed and expressions obtained connecting the amplitude of the input and output signals of the circuit being investigated at the given circuit parameters and input signal. A specific circuit for an electronic key is given, assembled from semiconductor diodes, and the ratios needed for selection of the parameters of such a circuit were obtained. Author

N65-24153 Joint Publications Research Service, Washington, D. C.
AN ELECTRONIC PHASE INVERTER
R. G. Karpov and B. D. Shapkin *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 13–18 refs (See N65-24150 13-09) CFSTI: $6.00

The electronic circuit of a phase inverter controlled by direct-current voltage by means of variation of the existing value of the output resistance of a cathode follower, with a load shunted by a silicon diode, is considered. Author

N65-24154 Joint Publications Research Service, Washington, D. C.
A STATIC CONVERTER OF THE VALUES OF ACTIVE POWER WITH THE USE OF NON-LINEAR SEMICONDUCTOR RESISTANCES
A. V. Fremke, D. N. Mokiyenko, and V. Ya. Kuz'min *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 19–26 refs (See N65-24150 13-09) CFSTI: $6.00

A static converter of the values of active power of a three-phase alternating-current circuit to direct-current voltage (0 to 10 V) and direct current (0 to 5 mA) is described. As the quadratures in the converter, nonlinear semiconductor resistors (NPS) are used. The basic error of the converter and errors due to the effect of external factors do not exceed ±1.5 percent. Author

N65-24155 Joint Publications Research Service, Washington, D. C.
A DEVICE FOR MEASURING THE TEMPERATURE OF ROTATING BODIES
A. V. Fateyev, V. A. Oleynikov, V. I. Zlatkin, and D. I. Likerman *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 27–34 refs (See N65-24150 13-09) CFSTI: $6.00

A method of contactless measurement of the temperature of rotating bodies, based on the use of inductive pickups of special design, is described. A complete circuit diagram is given, and also the results of tests of a model of the contactless device. Author

N65-24156# Joint Publications Research Service, Washington, D. C.
MEASURING AC AND VOLTAGE CONVERTERS WITH A UNIFIED OUTPUT SIGNAL
Ye. M. Dushin and V. Ya. Artem'yev *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 35–40 refs (See N65-24150 13-09) CFSTI: $6.00

The selection of circuits and elements of measuring ac and voltage converters with a unified output signal (direct current or voltage) are explained. Technical data of current and voltage converters are given, developed for power-engineering projects. Author

N65-24157 Joint Publications Research Service, Washington, D. C.
ANALYSIS OF ONE MEASURING CIRCUIT FOR AUTOMATIC ELECTRONIC POTENTIOMETERS MEASURING TEMPERATURE
A. A. Kol'tsov and G. Kh. Valeyeva *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 41–47 refs (See N65-24150 13-09) CFSTI: $6.00

A bridge measuring circuit with marking currents independent of the temperature of the potentiometer is described. The calculation of the circuit providing the minimum error is considered, and this error is caused by the change in the temperature of the free ends of the thermocouple. The two known measuring circuits with temperature compensation, intended for potentiometers, are characterized by the fact that one of the two marking currents of the instrument increases or reduces when the temperature T_1 of the air surrounding the potentiometer changes. Author

N65-24159 Joint Publications Research Service, Washington, D. C.
SEMICONDUCTOR INVESTERS WITH PULSE-WIDTH MODULATION FOR ELECTRIC DRIVE SYSTEMS
T. A. Glazenko *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 53–65 refs (See N65-24150 13-09) CFSTI: $6.00

Several new circuits for frequency conversion with voltage pulse-width modulation are considered. Basic computational relationships for three-phase thyristor inverters are given. Author

N65-24161 Joint Publications Research Service, Washington, D. C.
CONCERNING THE POSSIBILITY OF CONNECTING TWO INDEPENDENT SERVO SYSTEMS IN ONE COMMON AMPLIFIER
I. D. Alimov *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 77–83 refs (See N65-24150 13-09) CFSTI: $6.00

The transfer functions of two servo systems with two-phase induction motors connected to one common amplifier are considered. The degree of their mutual effect is analyzed, as well as the principal possibility of operation without crosstalk in the statistical and dynamic modes. Experimental results are cited. Author

N65-24163 Joint Publications Research Service, Washington, D. C.
THE OPERATION OF A SWITCHING PHASE DISCRIMINATOR FOR SQUARE-PULSE VOLTAGES
V. N. Drozdov *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 95–99 refs (See N65-24150 13-09) CFSTI: $6.00

The operation of a switching phase discriminator for square-pulse voltages is considered. Expressions are derived for the transfer characteristic, the discrete transfer function, and the continuous transfer function of the discriminator. Author

N65-24174 Joint Publications Research Service, Washington, D. C.
CONCERNING THE THEORY OF CONTACTLESS ELECTRIC CLOCKS
Z. M. Aksel'rod *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 193–200 refs (See N65-24150 13-09) CFSTI: $6.00

Certain types of low-frequency starting regulators of small contactless electric clocks are studied. Equations are calculated which express the relationship between the basic parameters of the starting regulator; and curves are plotted illustrating the nature of the relationship between the precision and operating conditions of the clocks and the supply voltage. Author

N65-24179 Joint Publications Research Service, Washington, D. C.
SEMICONDUCTOR THERMOELECTRIC COOLERS OF TRANSISTORS
V. K. Garachk and V. A. Nayer *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 229–234 refs (See N65-24150 13-09) CFSTI: $6.00

A description of the design and of the results of investigation of semiconductor thermoelectric coolers of transistors operating in environments at high temperatures is presented. Author

N65-24180 Joint Publications Research Service, Washington, D. C.
THERMAL CONDITIONS OF POINT-CONTACT OF SOLID-STATE CIRCUIT
D. I. Zaks *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 235–239 refs (See N65-24150 13-09) CFSTI: $6.00

A solution is given for a steady-state equation of heat conductance in a centrally symmetric model. The obtained results enable one to determine the influence exerted by thermoelectric effects on the thermal parameters of a point contact of a solid-state circuit. Author

N65-24187# Bendix Corp., Southfield, Mich. Research Labs. Div.
EXPLORATORY DEVELOPMENT OF THE Q-FACTOR TECHNIQUE Fourth Quarterly Progress Letter, Period Ending Mar. 31, 1965

Max Frank 10 Apr. 1965 73 p refs
(Contract AF 29(601)-6316)
(Rept.-2899; AD-614618)

Mean composite radiation damage constants, including the percent relative dispersion, are reported as a function of emitter current density for 22 different n-p-n silicon transistor types irradiated in a neutron environment of 7×10^{13} n/cm^2, E>0.1 MeV. A technique is described for the resolution of reciprocal gain into damage effect components in the base and space charge regions. The technique yields different damage constants for each region and results in a more accurate description of the radiation effects. Results are given for the application of this method. A discussion is included of the determination of transistor physical parameters required for prediction of radiation damage, using the Boothroyd–Trofimenkoff model with data derived for the 2N1613 transistor. Results are shown from an isochronal annealing experiment performed on two pairs of 2N1613 transistors, one pair previously irradiated in neutrons and the other in a Cobalt 60 environment, each pair consisting of an actively and a passively irradiated unit. Author

N65-24197# General Electric Co., Schenectady, N. Y. Tube Dept.
SUPERPOWER MILLIMETER WAVE TUBE Final Report, 15 Oct. 1963–15 Nov. 1964
H. L. Thal and R. G. Lock [1964] 96 p refs
(Contract DA-36-039-AMC-03409(E))
(Rept.-13; AD-614569)

Experiments were performed on the frequency locking of magnetrons using both reciprocal (special waveguide tee junctions) and nonreciprocal (circulators) coupling techniques. The results presented include the locking of a single magnetron having a second-order output circuit with circulator coupling and a three-tube array with reciprocal coupling that gave a 15-dB gain and 600-kw output at X-band. Packaged magnetrons were used in these experiments without any modifications, and thus the results are intended to demonstrate the principles involved without implying that they represent optimized performance. An equivalent-circuit model whose parameters are experimentally determined is presented. The good quantitative agreement between the performance predicted by the model and all of the experimental results is shown. Multimagnetron arrays were designed by an active filter theory. Computer programs were developed for predicting the matched and mismatched load performance and the self-oscillating modes of these arrays. In addition to the arrays actually built and tested, other arrays were designed and evaluated on the computer to demonstrate some significant aspects of magnetron locking. Author

N65-24210# Clevite Corp., Palo Alto, Calif. Shockley Research Lab.
NEW CONCEPTS FOR SOLID STATE MICROWAVE GENERATORS Seventh Quarterly Report, 1 Jul.–31 Oct. 1964
R. M. Scarlett [1964] 38 p refs
(Contract DA-36-039-AMC-00001(E))
(Rept.-7; AD-614000)

A series of experimental SCAT devices, all basically planar structures, were made. Different substrate (drain) resistivities, different source diffusion schedules, and different means of producing the thin oxide under the gate region were investigated. Two geometries were used, a circular and a stripe configuration. Although few consistent results were achieved, it appeared that the best oxide of those investigated was produced by thermal oxidation in dry oxygen at 1100° C. By observing light emission, it was found that the operation was probably quite nonuniform, accounting for the transconductance being less than calculated. Two types of drift in the characteristics were noted, one reversible upon reversing gate to source voltage, and the other apparently irreversible. The first was traced to ion motion on the oxide surface, but the second is not yet understood. Author

N65-24240# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
LOW NOISE NARROW-BAND AMPLIFICATION WITH FIELD EFFECT TRANSISTORS
Louis Mourlan, Jr. and Wayne A. Rhinehart Feb. 1965 58 p refs
(Contract W-7405-ENG-82)
(IS-1152) CFSTI: $3.00

The problem of detecting the presence of signal levels which approach the noise levels in available amplifying devices is discussed. Factors which limit amplifier sensitivity and steps the circuit designer can take to maximize sensitivity are covered. Low noise, narrow-band amplifier design, relative to the field effect transistor, is discussed. Author

N65-24311# Japan Broadcasting Corp., Tokyo. NHK Technical Research Labs.
COLOR TRANSMISSION IN TELEVISION SYSTEMS
Haruo Sakata Feb. 1965 41 p refs
(S-1)

In reproduced color images in color television, occasionally certain colors look more brilliant with increased chromaticity, or certain colors appear dull with decreased chromaticity as compared with the colors of the objects. Considering that the transmission of color from the object to the reproduction system is a transmission of three primary color signals, and applying the method of symmetrical coordinates to these three primary color signals, it has been determined that this type of color distortion is due to the unsymmetry of the three primary color signals. The cause of the distortion is attributed to the presence of a negative phase component and a zero phase component in each of the three primary color signals, in addition to their positive phase components which are necessary for color transmission. Apart from the masking circuit, which was used for a color distortion correction, a system for eliminating directly the negative and zero phase components was proposed. Author

N65-24356*# Army Biological Labs., Fort Detrick, Md. Physical Defense Div.
INVESTIGATION OF MICROBIAL CONTAMINATION INSIDE IRRADIATED AND HEATED ELECTRONIC COMPONENTS
Dorothy M. Portner 20 Apr. 1965 5 p refs
(NASA Order R-35)
(NASA-CR-62873) CFSTI: HC $1.00/MF $0.50

Electronic components, which had been irradiated with various doses or had been exposed to dry heat, were tested for internal microbial contamination. In the testing procedure nine untreated components were used as controls. Of these nine components only one was contaminated. Five of twenty-two radiation-treated components were contaminated, and none of six dry-heat-treated components contained bacterial spores. C.L.W.

N65-24364# Army Electronics Labs., Fort Monmouth, N. J. Electron Tubes Div.
EXPERIMENTS WITH A SYMMETRICAL, GRADIENT-GRID THYRATRON

John E. Creedon Jan. 1965 16 p
(ECOM-2554; AD-613216)

A study of the problems associated with the design of high-voltage thyratrons was conducted. The initial device selected is an experimental gradient-grid thyratron that has a symmetrical stacking arrangement to achieve high-voltage holdoff. The design consists basically of a series of split, baffled, and cavity grids. The purpose of the cavity is to permit sufficient length on the ceramic spacers to prevent external arcovers. Tests were performed on a 120-kV peak voltage modulator. The modulator consists of a 3.3-microsecond line with a characteristic impedance of 20 ohms, a matched load, and a resonance charging rate of 300 pps. Measurements obtained on a triple-gap structure are discussed. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N65-23427 National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.

A LABORATORY STUDY OF THE EFFECTS OF WIND ON D-C CORONA

M. M. Khalifa and R. M. Morris *In its* Bull. of the Radio and Elec. Engr. Div., Vol. 14, No. 4, Oct.-Dec. 1964 Dec. 1964 p 4-7 refs (See N65-23425 13-07)

Tests were begun on a single high-voltage dc corona source to study the effect of wind on corona of each polarity separately. The source was in the form of a conical brass point projecting from a 1/4-inch diameter smooth aluminum conductor connected to a high-voltage source. The conductor was set parallel to another grounded conductor. Wind from a small set of blowers was blown at speeds up to 14 mph across the two conductors. This considerably affected the corona loss which increased with the wind blowing in the positive direction from the corona point to the grounded conductor, and decreased for the opposite wind direction. This wind effect was attributed to the increase of ion velocities between the conductors when the wind blew in their direction of flow in the electric field, and to a decrease in velocity when the wind blew in the opposite direction. Tests were also made on an ac corona and showed no effect of wind. This was attributed to the basic difference between the mechanisms of ac and dc corona loss. In ac corona, losses are caused by ions oscillating and recombining near the respective conductors during successive half-cycles, while in dc corona the ions cross the whole gap between the conductors. E.E.B.

N65-23852 Japan Broadcasting Corp., Tokyo. Technical Research Labs.

STUDY OF TRANSISTOR VIDEO AMPLIFIER WITH FEEDBACK LOOPS Technical Monograph No. 5

Yasushi Fujimura Feb. 1965 76 p refs

The inverse root-locus method developed for the field of automatic controls is useful for designing feedback-type video amplifiers. The inverse root locus obtained represents the familiar functions of Butterworth, Bessel, etc. The margin of oscillation, the return difference of the negative feedback and the sensitivity to drift of some parameters are examined and compared with the design method by the Bode diagram. This method can be applied for the design of both low and high frequency transfer characteristics. The nth-order multipole low frequency transfer function is discussed. Several characteristics of single-stage transistor feedback amplifiers are analyzed by the inverted π equivalent circuit of transistors which was unilateralized and derived. Some error due to the approximation of the equivalent circuit is found to occur in transistors with large effective excess phase shift. However, this equivalent circuit is useful for designing single stage video amplifiers. Characteristics of the multistage feedback-type video amplifier are also analyzed and the design method for multistage amplifiers obtained. The features of the feedback loops were determined by employing the signal flow graph. Author

N65-23932*# Johns Hopkins Univ., Baltimore, Md. Carlyle Barton Lab.

SPREADING RESISTANCE AS A FUNCTION OF GEOMETRY AND FREQUENCY

L. E. Dickens Feb. 1965 74 p refs
(Contract NAS5-3546; AF 33(657)-11029)
(NASA-CR-62752; NAS-1) CFSTI: HC $3.00/MF $0.75

The equivalent circuit applicable to most semiconductor diodes contains a term, R_s, called the spreading resistance which is a very critical parameter of any diode. In a mixer diode, R_s limits the conversion efficiency and increases the noise temperature. In parametric amplifiers, R_s affects the overall impedance levels and determines the minimum noise figure of which the amplifier is capable. In harmonic generators it drastically affects the conversion efficiency as it not only dissipates power at the input and output harmonic frequencies but also at every idler frequency for which current may flow through the diode. The R_s can be measured, but it is most important to be able to predict, beforehand, the value of R_s for a given geometry as well as frequency. The geometrical variations are well demonstrated by calculations of R_s at low frequencies for which solutions of Laplace's equation hold. The resistance of two typical configurations is given for a wide range of geometries. The data are presented in graphical form. Problems encountered when evaluating high frequency operation are detailed. The point contact diode configuration is examined, and the field equations are derived in terms of the oblate spheroidal coordinates. It is shown that this is the natural coordinate system for such an analysis and that the spreading resistance is quite easily derived in this system. Author

N65-24016*# Northrop Space Labs., Huntsville, Ala. Space Systems Section

APOLLO EXTENSION SYSTEM LSV STUDIES. MISSION COMMAND AND CONTROL

Arch W. Meagher and Robert J. Bonham Huntsville, Ala., NASA. Marshall Space Flight Center, 19 Apr. 1965 52 p refs
(Contract NAS8-11096)
(NASA-CR-61051) CFSTI: HC $3.00/MF $0.50

This study is limited to concepts of steering and the circuits involved. Root locus plots are presented for a basic part of the control complex where the system can be linearized. To obtain the constants necessary to determine the transfer functions for the root locus study, a number of steering motors were reviewed. The results are shown in the appendix. Since the control of the LSV will depend to a large degree on the performance of the operator, research concerning experiments in this area is reported. The application of the results of the experiments to the LSV operator is discussed. Synchronizing of the individually controlled wheels is discussed, and a conceptual design for synchronizing circuits is presented. Limits of operation of the LSV vary with conditions of speed and terrain. Automatic control of these limits is discussed. Author

N65-24090# Weapons Research Establishment (Australia).
DESIGN CURVES FOR CIRCULAR POLARISERS IN U.S. MILITARY APPROVED CYLINDRICAL WAVEGUIDES CARRYING THE H_{11} (TE_{11}) WAVE
J. R. Pyle Jan. 1965 69 p refs
(WRE-TN-PAD-95)

Design curves for circular polarization of the H_{11} (TE_{11}) wave were computed for 22 sizes of cylindrical waveguide. The waveguide sizes cover the frequency band 2830 mc/sec to 87 200 Mc/sec. Author

N65-24113*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICAL CONDUCTIVITY OF A MEDIUM CONTAINING AN ARRAY OF WIDELY SEPARATED, PERFECTLY CONDUCTING, CYLINDERS
A. R. Sass 8 Apr. 1964 6 p refs
(NASA-TM-X-51687) CFSTI: HC $1.00/MF $0.50

The effective conductivity between rows in an array of widely separated, perfectly conducting cylinders is considered, using the same method of conformal mapping that is used to calculate the interelectrode capacitances of an idealized planar triode. S.C.W.

N65-24126* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STUDIES IN MINIMAX CONTROL
Kenneth J. Davis and David A. Ford *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 2–9 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

This report presents a new formulation of a minimax problem in launch booster control, and a summary of work done. The minimax problem described is a mathematical one whose solution would yield a controller which would minimize the maximum possible value of some selected analytical index of booster performance. Author

N65-24127* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A BOUNDARY VALUE FORMULATION FOR SPACE VEHICLE GUIDANCE
Robert Silber *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 12–16 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

This paper discusses the general notion of guidance of space vehicles, the purpose of which is to arrive at an understanding and description of the decision process central to the steering of a space vehicle. In many cases, the decision process can be embodied in a set of mathematical functions, called control laws. Numerical representation of the control laws is also considered. This may be accomplished with the aid of a digital computer by expansion of the control laws in Taylor's series about known data. This procedure is described and explained. Author

N65-24158 Joint Publications Research Service, Washington, D. C.
ON THE PROBLEM OF EVALUATING THE RELIABILITY OF MEASUREMENT
V. P. Kontorovich *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 48–52 refs (See N65-24150 13-09) CFSTI: $6.00

The aging and wearing out of elements of a measuring device lead to additional errors and, consequently, to a change in the given error of the results of measurements. The magnitude of the increase in the latter may be selected as the quantitative characteristics of reliability. The principal connection between the given error because of wear and aging and the change in the quantity of information arriving from the measuring device is shown. Author

N65-24167 Joint Publications Research Service, Washington, D. C.
GENERALIZED PARAMETERS OF DIFFERENTIATING AND INTEGRATING SYSTEMS
L. Ya. Nagornyv and L. Ya. Il'nitskiy *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 133–145 refs (See N65-24150 13-09) CFSTI: $6.00

Formulas are given for the sensitivity, Q-factor, and error in differentiating and integrating systems. These formulas are expressed by a matrix determinant of circuit conductance and its algebraic complement. The parameter calculation of the differentiators and integrators is sufficiently general so that it can be used for any circuit configuration. The use of the obtained formulas is illustrated. Author

N65-24170 Joint Publications Research Service, Washington, D. C.
SYNTHESIS OF THE DYNAMIC CHARACTERISTICS OF SYSTEMS FOR CONVERSION OF NAVIGATIONAL DATA FOR A CONTROL REGIME
I. B. Chelpanov *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 171–176 refs (See N65-24150 13-09) CFSTI: $6.00

Using the theory of filtration of random signals, the problem is considered of finding the characteristics of a device which converts the signal from a nonideal navigational instrument in an optimum manner. The navigational system enters into a closed system for controlling the motion of the object. Author

N65-24213# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y.
A NETWORK APPROACH TO THE DESIGN OF MULTILINE 2N-PORT DIRECTIONAL COUPLERS
Edward Ott Griffiss AFB, N. Y., RADC. Apr. 1965 54 p refs
(Contract AF 30(602)-2868)
(PIBMRI-1236-64; RADC-TR-65-41; AD-614650)

Four-port directional couplers which utilize coupled transmission lines were studied. The transfer impedance matrix of n+1 coupled lines is derived. Then the concept of a scattering matrix normalized to complex port impedances is introduced, and the transfer scattering matrix of the coupled line system is found. Due to certain convenient properties of the scattering formalism it is possible to demonstrate that any system of n+1 coupled transmission lines is a potential 2n-port directional coupler. Equations for the terminating impedances which make the coupled line system act as a directional coupler are derived. The sensitivity of the device to a small change in these terminations is investigated. Also, the results of tests made on an experimental 6-port directional coupler are presented. Author

N65-24221# Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
THE PERFECTLY COUPLED AND SHUNT-AUGMENTED T TWO-PORT
Kurt H. Haase Apr. 1965 123 p refs *Its* Phys. Sci. Res. Papers No. 90
(AFCRL-65-215; AD-614607)

A new two-port structure, referred to as a perfectly coupled and shunt-augmented T, is defined and its properties are described. The classical Brune two-port can be recognized as a particular example of this general class of two-ports. There are three feasible types (A, B, and C) of perfectly coupled and shunt-augmented T's. A tandem of two matched T's of type

AC or BC is equivalent to a lattice two-port. Suitable impedances can be transposed from one port to the other over the T whereby only the magnitudes of its elements are changed. The dual of this T is the perfectly coupled and series-augmented Pi. The discussion of these new kinds of two-ports is supplemented by 10 numerical examples. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N65-23426 National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.
NEW FACILITIES FOR D-C CORONA RESEARCH
R. M. Morris *In Its* Bull. of the Radio and Elec. Engr. Div., Vol. 14, No. 4, Oct.–Dec. 1964 Dec. 1964 p 1–3 refs (See N65-23425 13-07)

An installation for the study of corona loss and radio interference from transmission line conductors operating at high direct voltages was modified and extended to permit testing of bipolar systems consisting of two parallel conductors of opposite polarity. The new arrangement is shown schematically. Two single-span lines of variable spacing, height, and length of 370 ft were erected, one extending in the N.–S. and the other in the E.–W. direction. The spacing is variable up to 35 ft and the height is variable up to 40 ft. The sag can be made the same at each height. Facilities are available for installing a ground wire midway between bipolar conductors at a height variable up to 24 ft above them. Provision is also made for horizontal movement of the ground wire necessary for this positioning. The two conductors of each line are operated at opposite polarities, although for special tests they may be operated at the same polarity—an arrangement sometimes called homopolar. The entire outdoor installation was made as flexible as possible, not only to provide practical information about line conductors, but also to enable phenomena to be studied. E.E.B.

N65-23498*# National Aeronautics and Space Administration, Washington, D. C.
[KEY ASPECTS OF THE NATIONAL SPACE PROGRAM] News Release
James E. Webb 14 May 1965 16 p Presented at Rotary Club and Rotary Anns Luncheon, Cleveland Available from the Scientific and Technical Information Division

James E. Webb, Administrator, National Aeronautics and Space Administration, discusses some key aspects of the national space program with emphasis on the major research tools and facilities available at the Lewis Research Center that are designed to simulate many types of flight conditions, both in the atmosphere and in space. The importance of better electronics, more durable metals, lighter yet stronger pressure vessels, and more efficient heat exchangers for capability in aerospace is pointed out. G.G.

N65-23526*# National Bureau of Standards, Washington D. C.
DEVELOPMENT OF A STABLE ULTRAVIOLET SOURCE AND TECHNIQUES FOR ACCURATE RADIOMETRY Annual Summary Report, Jan. 1–Dec. 31, 1964
Henry J. Kostkowski, Charles R. Yokley, Diamond E. Erminy, and Albert T. Hattenburg [1964] 32 p ref
(NASA Order R-117)
(NASA-CR-62473; NBS-8664) CFSTI: HC $2.00/MF $0.50

CONTENTS:
1. A STABLE ARC SOURCE OF HIGH ULTRAVIOLET RADIANCE C. R. Yokley 20 p ref (See N65-23527 13-11)
2. A NEW HIGH ACCURACY SPECTRORADIOMETER H. J. Kostkowski, D. E. Erminy, and A. T. Hattenburg 8 p (See N65-23528 13-14)

N65-23527* National Bureau of Standards, Washington, D. C.
A STABLE ARC SOURCE OF HIGH ULTRAVIOLET RADIANCE
C. R. Yokley *In its* Develop. of a Stable Ultraviolet Source and Tech. for Accurate Radiometry [1964] 20 p refs (See N65-23526 13-11)

A high pressure argon arc with an intense continuum was developed as a possible source in ultraviolet radiometry. The wall-stabilized, continuously operating arc exhibits radiance temperatures of about 5000 °K at 2400 A. Typical operating conditions are currents from 50 to 100 amperes and pressures from 5 to 25 atmospheres. Reproducibility of spectral radiance calibration is about 3% when argon flow, arc current, and chamber pressure are regulated within prescribed limits. Short term reproducibility over several hours is about 1% in spectral radiance. The spectral radiance is approximately proportional to the square root of the pressure with an upper stability limit of 375 psia for 50 ampere arcs. The arc design, stabilizing and operating techniques along with typical spectral radiance calibrations from 2200 to 7000 A is given. Author

N65-23541# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRIC WIND TUNNEL AIR HEATER, PREFERABLY OF GREATER SUPERSONIC SPEED WIND TUNNELS
A. Ts. Bosis, A. L. Iskra, and S. S. Ustinov 18 Mar. 1965 6 p Transl. into ENGLISH from Soviet Patent No. 119364 (Appl. No. 607734/27, 16 Sep. 1958) 4 p
(FTD-TT-64-1084/1+2; AD-613173)

An electric wind-tunnel heater for maintaining uniform temperatures of the air entering the nozzle of a supersonic wind tunnel is described. It utilizes a rectifying tunnel grid made of material with great ohmic resistance as the electric resistance element, to which the electroheating elements are soldered. An electric current is run over the heating elements when the wind tunnel is in operation, and the entering air is heated to the given temperature when it washes the surface of the heated elements. The voltage can be raised by increasing the current movement through an increase of heater sections. G.G.

N65-23546# Rochester Univ., N. Y. Dept. of Physics and Astronomy
AN IMPROVED STRIP SEALED CONTINUOUS ROTATION SCATTERING CHAMBER
R. A. Hawrylak, D. Cline, and D. F. Grube 7 Apr. 1965 14 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-81)

An improved design is described of an evacuated chamber having two ports in a horizontal plane. The angle between these ports can be changed continuously through an angular range of 180° from −10° to +170° without disturbing the high

vacuum maintained inside. A well-known principle of a flexible strip sealed slot is employed here with some refinements which result in reliable operation. Author

N65-23631 Academy of Sciences (USSR), Moscow. Astronomical Council
AN OPERATION DESK FOR A SATELLITE TRACKING STATION [PUL'T OPERATORA STANTSII VIZUAL'NYKH NABLYUDENIY ISZ]
E. A. Pavlyniv, Yu. I. Safronov, and V. A. Melenevskiy-Grishchenko *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 18–19 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

The construction of a desk for operators at a satellite tracking station, for use during observations, is described. Author

N65-23648# Federal Aviation Agency, Atlantic City, N. J. Experimental Div.
IMPROVED EQUIPMENT ARRANGEMENTS FOR ARTC CENTERS Final Report
George A. Scott Mar. 1965 98 p
(RD-65-27)

Through the use of an environmental laboratory, the In-line, Peninsula and Island console designs were established, modified and appraised. Field controller opinion and recommendations were the basis for determining the advantages or disadvantages of particular equipments and their locations, console modifications and configurations. The report recommends the most favorable placement of operational equipments and controls, as well as substantial improvements in sector lighting, information displays and hardware modification. Author

N65-23658# School of Aerospace Medicine, Brooks AFB, Tex.
A SPATIAL DISORIENTATION DEMONSTRATOR
Sidney T. Lewis, Henry B. Whitmore, Leonard Harris, and Donal Mc Dougall Mar. 1965 10 p refs
(SAM-TR-65-7; AD-461347)

A spatial disorientation device was designed and constructed. This device is inexpensive, easy to operate, and portable. It combines the principles of the Bárány chair and centrifuge. Author

N65-23842# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
CURRENT CAPABILITIES FOR CONDUCTING ENVIRONMENTAL TESTS
C. M. Austin 2 Nov. 1964 119 p
(QE/C-64-731; AD-613640)

The primary function of the laboratory is to determine the life, durability, quality, and reliability of weapons systems and components. The laboratory has a broad scope of testing equipment and facilities to meet requirements for the simulation of climatic and dynamic environmental conditions, and to simulate functionally any installation in aircraft, missiles, and shipboard equipment. The total environmental test capability is available for developmental, acceptance, and surveillance evaluations of weapons systems and components, including explosive pyrotechnics. A separate facility is available for the environmental testing of explosives. Further, facilities are available for scientific photography and industrial radiography. The environmental test equipment capabilities of the laboratory are presented in detail. E.E.B.

N65-23846# General Motors Corp., Santa Barbara, Calif. Aerospace Operations Dept.
AEROSPACE RESEARCH CAPABILITIES
Apr. 1964 210 p refs
(TR63-223, Rev.)

The aerophysics range, described in detail, is a hypervelocity free-flight range capable of simulating to a high degree actual flight conditions associated with ICBM and space vehicles. The light-gas gun launchers used in the range are capable of firing aerodynamic models at velocities up to 30 000 ft/sec. Equipment developed by the microwave laboratory, also described in this report, is used to investigate the effects of various parameters on the radar-echoing properties of flight vehicles. The terminal ballistics laboratory employs high-explosive projection techniques to propel projectiles at speeds in excess of 50 000 ft/sec. The weapons and space systems laboratory is conducting research in spinning-body control systems, rotating-vehicle dynamics, optical systems, warhead design and development, extra-atmosphere radiation measurements, and nuclear effects on reentry vehicles. The group of buildings of the complex cover an area of 210 000 sq ft with approximately 90 000 sq ft of laboratory and office space in two buildings and 120 000 sq ft in the main building. E.E.B.

N65-23858# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 OCTOBER TO 31 DECEMBER 1964
R. S. Rangi et al [1964] 117 p refs
(DME/NAE-1964(4))

The development of a trisonic blowdown wind tunnel with a speed range of Mach 0.2 to Mach 4.5 including transonic, is reported. Schematic layout, model design, cost, and a brief description of the facility are presented. A study of dynamic pressure disturbances in the wind tunnel led to the development of a control system which used standard analytical procedures. An extensive computer study was successfully conducted to evaluate the effects of system nonlinearities and to optimize the control system for random disturbances in dynamic pressure. Also reported is the development of a response analyser for measuring random structural excitation. This system produces a voltage waveform proportional to the differences of successive extremums of a random varying voltage. The apparatus operates in the 1- to 100-cps frequency range. Data are also included on current projects in mechanics, hydrodynamics, aerodynamics, and thermodynamics. S.C.W.

N65-23898# Aeronautical Research Council (Gt. Brit.)
NOTES AND COMMENTS ON SOME PARTICULAR FEATURES OF WIND-TUNNEL DESIGN FOLLOWING MEASUREMENTS OF FLOW DISTRIBUTION, WALL PRESSURES ETC. IN THE N.P.L. 7 FT (LOW TURBULENCE) WIND TUNNEL
C. Salter and W. G. Raymer London, HMSO, 1965 24 p refs Supersedes NPL-AERO-1023, ARC-25256; see X64-16338 (ARC-R&M-3399; NPL-AERO-1023; ARC-25256) HMSO: 9s 6d

Performance data from a modified 7 ft low-turbulence wind tunnel, that incorporates a fan design of thin vanes between the original thick ones, are presented. Measurement instrumentation consisted of pitot- and static-pressure tubes, a surface creeper tube, a manometer, and a vane anemometer. It was concluded that the flow in the working section showed good uniformity and pressure gradient with a reasonably low level

of turbulence. The effective contraction ratio was only about 5 1/2 instead of 7 due to too close positioning of the smoothing screens. G.G.

N65-23930*# Air Products and Chemicals, Inc., Allentown, Pa.
A DESIGN STUDY OF A HELIUM RECOVERY SYSTEM FOR MILA. VOLUME I: SYNOPSIS
[1965] 42 p With Drawings
(Contract NAS10-1472)
(NASA-CR-62747) CFSTI: HC $2.00/MF $0.50

This three-phase study evaluates various methods for recovering and repurifying helium gas required for the flight preparation and launch of space vehicles and Phase I investigates quantity and locations of recoverable helium from the Saturn V–Apollo vehicle operational system at Launch Complex 39, MILA. The helium to be recovered is used for checkout of the Saturn V Space Vehicle at the various areas of LC-39. The usage data were expanded to include the Saturn IB complexes 34 and 37 and associated systems. Phase II evaluates the various recovery and repurification system concepts and/or combination of concepts for application to the Saturn vehicle operation systems. Author

N65-23931*# Air Products and Chemicals, Inc., Allentown, Pa.
A DESIGN STUDY OF A HELIUM RECOVERY SYSTEM FOR MILA, VOLUME II Final Report
[1965] 188 p With Drawings For abstract see N65-23930 13-11)
(Contract NAS10-1472)
(NASA-CR-62744) CFSTI: HC $5.00/MF $1.25

N65-24015*# Hayes International Corp., Birmingham, Ala. Apollo Logistics Support Group
APOLLO LOGISTICS SUPPORT SYSTEMS MOLAB STUDIES. LUNAR SHELTER/ROVER CONCEPTUAL DESIGN AND EVALUATION
E. C. San Juan Huntsville, Ala., NASA. Marshall Space Flight Center, Nov. 1964 108 p refs
(Contract NAS8-5307)
(NASA-CR-61049) CFSTI: HC $4.00/MF $0.75

The evaluation of past efforts on lunar shelters and small roving vehicle payload combinations, and the development of the most promising design concept are presented. Also shown is the capability of a lunar shelter-laboratory (SHELAB) to provide housing and support equipment for the scientific exploration of the lunar surface, and the design of the shelter is discussed. It will support two astronauts for a 14-day mission. This shelter will be the payload of the LEM/T, and includes the 1-astronaut traversing vehicle (LTV) which will be utilized for traversing, exploring, drilling, and other missions designated for the roving vehicle. Author

N65-24019*# National Aeronautics and Space Administration, Washington, D. C.
APOLLO PROGRAM: MASS PROPERTIES STANDARD
M. L. Seccomb 1 Jun. 1965 92 p Updates M-DE-8000.006 (SP-6004; CMO-18-001-1) CFSTI: HC $3.00/MF $0.75

This document establishes a system for the management of mass properties during procurement and use of space vehicles. It is designed to permit acquisition of systematized, verifiable and controllable mass properties of vehicle systems, to facilitate rapid establishment and reporting of inputs for the weight–performance relationship, and to enable parametric extrapolation from the reported systems to newly evolving systems. Author

N65-24023# Joint Publications Research Service, Washington, D. C.
SOLDERS COMPOSED OF NOBLE METALS AND ALLOYS
V. A. Golovin and E. Kh. Ul'yanova 13 May 1965 17 p Transl. into ENGLISH from the book "Svoystva Blagorodnykh Metallov i Splavov" Moscow, 1964 p 169–180
(JPRS-30064; TT-65-30985) CFSTI: $1.00

The durability of joints soldered with Au–Ag–Cu alloys is significantly superior to those soldered with gold solders which contain zinc and cadmium. In soldering platinum, pure gold can be used, but joint durability is inferior to a joint soldered with tricomponent gold alloys. Solders of Ag–Cu–Sn can be used as a solder in vacuum devices. However, in such devices the zinc and cadmium content should not exceed 0.005%. Nickel can be introduced into silver solders when they contain copper. Nickel increases the durability of such solders with little effect on the pliability. Also, the introduction of nickel in polycomponent solders improves the wetting ability of solid solutions, and increases resistance to joint corrosion. The introduction of cadmium lowers the melting point, increases fluidity, and provides a durable, pliable joint. Silver–copper–zinc–cadmium solders can be used to solder hard alloys and stainless steel but cannot resist high temperatures. E.E.B.

N65-24026*# Air Products and Chemicals, Inc., Allentown, Pa.
A DESIGN STUDY OF A HELIUM RECOVERY SYSTEM FOR MILA. VOLUME III: HELIUM USAGE AND RECOVERY EQUIPMENT SUPPORTING DATA
[1965] 98 p refs
(Contract NAS10-1472)
(NASA-CR-62794) CFSTI: HC $3.00/MF $0.75

A consolidation of data gathered during Phase I of the helium recovery study concerning Grade A helium usage and availability, is presented. A detailed tabulation of the helium used for each Saturn V and Saturn IB checkout and launch operation is reported. Phase I of the helium recovery study was concerned with the amount and sources of recoverable helium at the following locations: (1) Saturn V System: launch complex 39 MILA, industrial area, and various checkout buildings; and (2) Saturn IB System: launch complex 34, and launch complex 37. The report includes tabulated source data, calculations, and vendors' quotations to support the conclusions presented. S.C.W.

N65-24042*# General Precision, Inc., Binghamton, N. Y. Aerospace Systems Engineering Dept.
DESIGN STUDY FOR VISUAL CUE SIMULATOR Addendum to Final Report
6 Dec. 1963 23 p
(Contract NAS1-1904)
(NASA-CR-53600) CFSTI: HC $1.00/MF $0.50

The gimbal rate equations which were previously developed were dependent on the effective fixed frame components of the rotational velocity vectors of the various moving frames of reference. The effective fixed frame components must impart rotations to a given projector which are equivalent to the actual rotation, which can be considered to be taken about the center of vision. In order to find this equivalent rotation, the intermediate step of finding the equivalent rotation about the center of the sphere was introduced. The problem of finding the equivalent rotation about the center of the sphere was solved by looking at each rotation

individually. The finding of the individual rotational rates in the direction of the unit vectors $\bar{i}_o$, $\bar{j}_o$, and $\bar{k}_o$ were thereby simplified. These rotational rates were then transformed into the Euler angle rates. E.E.B.

N65-24043 Aeronautical Research Council (Gt. Brit.)
HIGH PRESSURE REAL GAS DRIVERS AND TAILORING IN SHOCK TUNNELS
L. Davies London, Min. of Aviation, 1965 19 p refs Supersedes NPL-AERO-1088, ARC-25486
(ARC-CP-770) HMSO: 4s

The lack of significant variation in specific heat ratio in helium with temperature (300° to 90° K) results in a marked change in tailoring Mach number with change in diaphragm pressure ratio requirements at increasing driving pressures ($\leq$ 10000 lb/in.^{2}). Author

N65-24061# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
A PULSED REFRIGERATION SYSTEM FOR CRYOGENIC MAGNET APPLICATION
T. R. Strobridge and D. B. Mann [1964] 21 p refs Presented as Paper No. H-10 at Cryog. Eng. Conf., Pennsylvania Univ., Philadelphia, 18–21 Aug. 1964 Sponsored by AEC Available from Natl. Bur. of Standards, Boulder, Colo.: $1.00

A new system for providing large amounts of refrigeration to a pulsed magnet is proposed. Incorporated into the system, which can be built with commercially available components, is a helium refrigerator with two expansion engines, a mass of helium in an insulated vessel which is used as a heat sink, and two low temperature circulation pumps. The system can be designed for a range of capacities and operating conditions. The results of calculations for one particular application are given. Author

N65-24217# Aerospace Corp., El Segundo, Calif. Manned Systems Div.
TITAN III GROUND CHECKOUT DATA TRANSMISSION SYSTEM
J. P. Janis 1 Apr. 1965 25 p
(Contract AF 04(695)-469)
(TDR-469(5116-57)-1; SSD-TDR-64-177; AD-463301)

The increased blast area associated with the 120-inch solid rocket motors used on the Titan IIIC required locating the launch control center 3 1/2 miles from the nearest launch complex. To transmit data over this distance, a data transmission system (DTS) with a transmission capability in excess of 5 miles was developed. The Titan IIIC DTS uses discrete, digital, and analog signals to monitor and control checkout and launch operations. Author

N65-24251# National Research Council of Canada, Ottawa. Radio and Electrical Engineering Div.
OPERATIONS REQUIREMENT FOR BLACK BRANT ROCKET AD-II-44
A. Staniforth and K. A. Steele Apr. 1964 71 p Revised
(ERB-662)

Black Brant Rocket AD-II-44 was instrumented to measure various phenomena associated with auroral activity. The instrumentation included an ejected package equipped for measurement of electron density detail structure by a radiofrequency impedance probe method, a second ejected package for measurement of the electric field potential profile, a cosmic-ray experiment concerned with the direction of energetic particles associated with auroral activity, Langmuir probe measurements of the fine structure of electron density, acoustic-type micrometeorite detectors, and a neutron detector utilizing the phoswich technique for energies in the range 0.2 to 10 MeV. Requirements for working space, transport, power, communications, meteorological, and other technical support are given. The test, the rocket, the telemetry used, and the data to be recorded are discussed. A detailed countdown is also included. Author

N65-24308*# Hayes International Corp., Birmingham, Ala. Missile and Space Support Div.
APOLLO LOGISTICS SUPPORT SYSTEMS MOLAB STUDIES. DIGITAL COMMAND SYSTEM FOR A LUNAR MOBILE LABORATORY
J. M. Patten Huntsville, Ala., NASA. Marshall Space Flight Center, 31 Mar. 1965 70 p refs
(Contract NAS8-5307)
(NASA-CR-61053) CFSTI: HC $3.00/MF $0.75

The MOLAB will be commanded to perform a wide variety of prescribed functions throughout its useful life on the moon's surface. The sphere of influence will extend to all major disciplines associated with the vehicle such as power, navigation, mobility, scientific instrumentation, and communication. Five discrete phases are given of command and control; an analysis of the proposed Gemini/Apollo digital command system, a listing of MOLAB functions that will require commands; a proposed system in point design that will satisfy these command requirements; a discussion of codes and coding technique; and a summary of multiaperture magnetic core functions. Author

N65-24314# Kitt Peak National Observatory, Tucson, Ariz.
[ACTIVITIES AT THE STELLAR, SOLAR AND SPACE DIVISIONS AND THE CERRO TOLOLO INTER-AMERICAN OBSERVATORY] Monthly Report, Feb. 1965
[1965] 14 p Sponsored by NSF

Construction of the inter-American observatory at Cerro Tololo was completed. Work in the stellar division included observations of stars brighter than 5th magnitude and of spectral types earlier than GO. Southern Hemisphere standards were established and about three observations were made for each program star. Design studies of the mounting for the 150-inch telescope led to several modifications. Observational programs with the 16-inch, 36-inch, and 84-inch telescopes continued. The photometry read-out system is being modified for pulse counting with output recording. The solar division modified the McMath telescope to eliminate the friction in the declination bearings. The space division concluded a study of the orientation of type II tails in 10 comets; a catalog of nearly 2000 observations on comet tail orientation is nearing completion; and studies of the photometry and polarimetry of the zodiacal light, and of the parallax of the Gegenschein continue. Author

N65-24342# Phillips Petroleum Co., Idaho Falls, Idaho.
SOLIDS FLOW CONTROL FOR A PULSED SOLIDS–LIQUID CONTACTOR
Earl S. Grimmett and Noel de Nevers Mar. 1965 53 p refs
(Contract AT(10-1)-205)
(IDO-14648) CFSTI: $3.00

The system receives solids from a slurry gas lift or a solids makeup system and feeds them to the top of the solids–liquid contactor. It utilizes a bed of solids, fluidized with water or some other process fluid, maintained at a constant density by regulating its flow. The constant density bed is withdrawn at a constant volumetric rate and introduced into the top of the contactor. It was possible to feed Dowex-50 ion-exchange resin into the contactor at controlled rates over a wide range of resin flow rates. The bottom flow system removes solids

from the bottom of the contactor and transports them by a gas lift to the top of the same contactor, to the top of a second contactor, or to the next piece of equipment in a process. The bottom flow system uses a fluidized bed, which receives solids from the downcomer of the bottom plate of the contactor and discharges them into a slurry gas lift line. This system was also tested with Dowex-50 resin over a wide range of solid feed rates and contactor pulse frequencies and amplitudes. Under all conditions, the system functioned smoothly. Author

N65-24353*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENVIRONMENTAL ACCEPTANCE TEST SPECIFICATION FOR THE FLIGHT MODEL UK-2/S-52 SPACECRAFT
Raymond Kruger 10 May 1963 18 p
(NASA-TM-X-56425) CFSTI: HC $1.00/MF $0.50

This specification establishes the Environmental Acceptance Tests for the Flight Model UK-2/S-52 Spacecraft. The purpose of these tests is to demonstrate satisfactory performance of the spacecraft under the various environments it may be exposed to during its lifetime. These tests are intended to discover any defects in material or workmanship and to provide information relating to the unique characteristics of the spacecraft. Included also are those operations, such as dynamic balancing, which are necessary for the proper functioning of the spacecraft. This specification is part of a series which, collectively, constitute a complete test program for the UK-2/S-52 Satellite. Final acceptance for flight of the Flight Model Spacecraft is subject to the satisfactory performance throughout this test program. Author

N65-24359*# MB Associates, San Ramon, Calif.
FEASIBILITY STUDY FOR DEVELOPMENT OF A HYPERVELOCITY GUN Final Report
D. E. Brast and D. R. Sawle May 1965 87 p refs
(Contract NAS8-11204)
(NASA-CR-62876; MB-R-65/40) CFSTI: HC $3.00/MF $0.75

Feasibility of various rail gun models was investigated. The guns consisted of a pair of metal rails sandwiched between two insulating slabs, and were 3 to 8 inches in length. Numerous elements were used as rail materials. The projectiles were nonconductive, and were driven by an arc plasma. A simple design with a condenser bank and pulse transformer was tested on cubic and spherical nylon projectiles of different sizes; more complicated two-stage systems, with auxiliary fields, and second condenser banks and pulse transformers, were also evaluated, but projectile velocities were not as high. In rail gun acceleration of plasmas, velocities upwards of 100 km/sec were achieved, which required magnetic fields of the order of a megagauss. Ohmic heat produced by such high fields melted current-carrying portions of the rails, and created pressures so high that the rails suffered plastic flow. Smaller accelerations of longer durations, however, resulted in greater loss of energy and in heating of the projectile by the arc through thermal conduction. Refinements in design are suggested for future investigation. J.M.D.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N65-23407 Joint Publications Research Service, Washington, D. C.
ACTION OF A WEAK SHOCK WAVE ON A BODY LYING AT AN INTERFACE OF TWO MEDIA
Ye. F. Afanas'yev *In its* Eng. Journal 26 Apr. 1965 p 45–57 refs (See N65-23402 13-23) CFSTI: $6.00

Forces which operate on a body lying at the interface of two media, and the equations of motion of the body are determined. A plane diffraction of a shock wave from a rectangular cross-section body lying at an interface of two compressible liquids is considered in linear representation. Movement of the body under the influence of the action of the wave is taken into account. The mathematical representation of pressure relationships in two auxiliary problems are given: (1) the diffraction of wave with respect to the rigid rectangular wedge, and (2) the impression of rigid stamp according to velocity equation from the liquid. R.C.S.

N65-23410 Joint Publications Research Service, Washington, D. C.
FLOWS OF DILATANT FLUIDS IN CYLINDRICAL AND PRISMATIC TUBES
V. V. Sokolovskiy *In its* Eng. Journal 26 Apr. 1965 p 74–88 refs (See N65-23402 13-23) CFSTI: $6.00

Dilatant fluid flow in cylindrical and prismatic tubes of arbitrary transverse cross sections when viscosity increases with an increase in displacement speeds is discussed. Basic equations of flow are presented and closed solutions of these equations are obtained. Mathematical analogy between a dilatant flow in cylindrical tubes and the plastic torsion of cylindrical rods, and fluid flow problems which correspond to the known problems of torsion of rods are considered. R.C.S.

N65-23414 Joint Publications Research Service, Washington, D. C.
CYLINDRICAL COUETTE FLOW IN A WEAKLY RARIFIED GAS
V. P. Shidlovskiy *In its* Eng. Journal 26 Apr. 1965 p 118–126 refs (See N65-23402 13-23) CFSTI: $6.00

Construction of solution for the equations used to investigate cylindrical couette flow in a weakly rarified gas is attempted. The steady movement of a gas between two adjacent cylinders under conditions where the inner cylinder is at rest and the outer cylinder rotates at a constant angular velocity is considered. The case where the coefficient of viscosity undergoes comparatively small changes in the entire flow region between the cylinders, and the friction stress in a cylindrical couette flow are investigated. Calculations of the coefficients of resistance presented here are compared with work by Lin and Street. R.C.S.

N65-23415 Joint Publications Research Service, Washington, D. C.
CONSTRUCTION OF AN ANALYTICAL JET BY THE HODOGRAPH METHOD
V. B. Gorskiy *In its* Eng. Journal 26 Apr. 1965 p 127–134 refs (See N65-23402 13-23) CFSTI: $6.00

The solution of the Chaplygin equation, which describes a plane irrotational flow of a gas, in the form of an infinitive series is calculated in the plane of a hodograph. The flow outside the axis of the jet which satisfies the equation of a plane gas flow is derived. After obtaining this solution, any two symmetrical lines of flow can be taken as the walls of the jet. R.C.S.

N65-23417 Joint Publications Research Service, Washington, D.C.
DETERMINATION OF THE DENSITY OF A GAS BEHIND A SHOCK WAVE BY SHADOW PHOTOGRAPHY
A. N. Semenov *In its* Eng. Journal 26 Apr. 1965 p 151–162 refs (See N65-23402 13-23) CFSTI: $6.00

Since accuracy of methodology is basically determined by accuracy of measurement of the width of the dark zone, the diffraction of Franel' is considered on the boundary of the geometric shadow and the diffractional distribution of illumination across the caustic, which permitted proposing a method for determining the width of the dark strip across the distance between the first diffractional maximums. The theory under consideration was used for determination of the relation of densities at the apex of a nonstationary axisymmetric shock wave formed in the interaction of a plane front of shock wave, stimulated in the channel of a shock tube, with a sphere.
Author

N65-23503 Joint Publications Research Service, Washington, D.C.
UNSTEADY EXPANSION OF A GAS INTO A VACUUM WITH VARIOUS LAWS AND DURATION OF ENERGY RELEASE
A. S. Fonarev *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 21–41 refs (See N65-23500 13-01) CFSTI: $6.00

Expansion of a gas into a vacuum was studied theoretically, based on differential equations of unsteady one-dimensional gas dynamics which describe the motion of a plane layer of an ideal gas of given mass entering a vacuum. A class of self-similar solutions are presented in the form of functions for gas pressure, velocity, and specific volume. These statements lead to asymptotic formulas, with coefficients derived from solutions for self-similar expansion, for various parameters of the adiabatic expansion of a gas with arbitrary initial profiles.
J.M.D.

N65-23504 Joint Publications Research Service, Washington, D.C.
THE FLOW IN THE VICINITY OF THE POINT OF INTERSECTION OF A SONIC LINE WITH A SHOCK WAVE
Yu. B. Lifshits *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 42–51 refs (See N65-23500 13-01) CFSTI: $6.00

It was established that the continuous flow in the local supersonic zone arising in a subsonic flow about a profile with $M_\infty > M_{cr}$ is unstable. In such a flow a shock wave closes the region of local supersonic velocities. It is assumed that the shock wave originates on the line of transition through the sonic velocity and extends to the profile. The first attempt to construct a model of such a flow was that of Frankl', but his solution has a fold in the flow plane and cannot be realized. Later Gor'kov and Pitayevskiy considered the problem of the reflection of a weak discontinuity from the sonic line in the form of a shock wave. Germain and Gillon constructed the flow in the vicinity of the point of the sonic line in which there is an infinite discontinuity of the second derivatives of the velocity with respect to the coordinates which is reflected in the form of a shock wave.
Author

N65-23505 Joint Publications Research Service, Washington, D.C.
ON THE ANALYSIS OF THE CHARACTERISTICS OF THE SEPARATED ZONE AND THE BASE PRESSURE IN SUPERSONIC FLOW OF GAS ABOUT BODIES
V. Ya. Neyland *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 52–63 refs (See N65-23500 13-01) CFSTI: $6.00

A method is presented for the calculation of the location of the separation point and the dimensions of the separated zone on a body in a supersonic gas flow. The flows about plane bodies at an angle of attack differing from zero and about axisymmetric bodies at zero angle of attack are considered. As an example of the application of the method, results are presented of the calculations of the characteristics of the separation zone of a laminar boundary layer on a wedge with a skirt. It is shown that the proposed method is suitable without essential change for the computation of the base pressure behind two-dimensional bodies with arbitrary shape of the body base region.
Author

N65-23509 Joint Publications Research Service, Washington, D.C.
THE DILATANT FLOW OF A FLUID IN TOROIDAL TUBES
V. V. Sokolovskiy *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 111–127 refs (See N65-23500 13-01) CFSTI: $6.00

Dilatant flow of a fluid in toroidal tubes of arbitrary cross section is studied. The basic flow equations are presented, and closed solutions for these equations are obtained. In addition, typical problems are considered of the steady state flow of fluids in toroidal tubes of circular and rectangular cross sections.
Author

N65-23517 Joint Publications Research Service, Washington, D.C.
EVALUATION OF THE EFFECT OF THE RELAXATIONAL BOUNDARY LAYER ON THE CHARACTERISTICS OF THE VISCOUS FLOW ABOUT A WEDGE
V. P. Agafonov *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 220–228 refs (See N65-23500 13-01) CFSTI: $6.00

A theoretical study of the region in which oscillatory relaxation in air has an effect on the characteristics of flow about a wedge is reported. Friction stress and thermal flux on a wedge with a 40° slope, for a gas whose coefficient of viscosity is linearly related to temperature, are analyzed for various states of the flow on the external edge of the relaxation boundary layer; in this case, the quantities corresponding to the flow with allowance for the relaxation boundary layer are beyond the limits of the fork between the values for the frozen and equilibrium flows. It was found that the presence of the relaxation boundary layer reduces the friction stress and the thermal flux, in comparison to the equilibrium flow, approximately to the values corresponding to the frozen flow.
J.M.D.

N65-23519 Joint Publications Research Service, Washington, D.C.
ON THE PENETRATION OF A NORMAL PRESSURE PULSE PROPAGATING WITH CONSTANT VELOCITY INTO AN IDEAL LAMELLAR MEDIUM
P. F. Sabodash *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 236–244 ref (See N65-23500 13-01) CFSTI: $6.00

The layer of an ideally compressible fluid of finite thickness, lying on an absolutely solid and fixed semispace, is considered theoretically. With the medium characterized by the density and the velocity of the longitudinal waves, the two-dimensional motion of a normal pressure pulse in the layer is described by a differential equation which is based on a single potential function. Boundary conditions are stated which lead to an integral form of the equation of motion. Solution to the generalized problem is then derived with the aid of a system of incident, reflected and refracted plane waves. The case of a fluid layer lying on an elastic, uniform, and isotropic semispace is also evaluated. An example is presented in which the behavior

of an acoustic medium during motion along the upper boundary, with pressure varying according to a specified step function, is analyzed. J.M.D.

N65-23567 Deutsche Akademie der Wissenschaften zu Berlin (East Germany). Sternwarte Babelsberg
GASDYNAMIC OCCURRENCES IN THE FIREBALL STAGE OF METEORS [GASDYNAMISCHE VORGANGE IM FEUERKUGELSTADIUM DER METEORE]
Hans Oleak 1964 64 p refs In GERMAN *Its* Veröffentl., V. 14, No. 6 Available from VEB Press Thomas Müntzer, Berlin: 9 DM

The important phenomena induced by the hypersonic flow of the gaseous continuity of a spheric meteor body in the earth's atmosphere are discussed with emphasis on the changes in enthalpy and temperature relationship. Evaluation of the temperature distribution around the meteoric body at different velocities and heights showed large temperature gradients along the surface, and it was concluded that the continuum flow takes place at much greater heights than has been assumed so far. Application of the above-mentioned parameters to the case of a bright meteor showed a dynamic temperature increase of about 3000° to 62 000° K in maximal luminosity even at decreased velocities due to the pressure dependence of the ionization. The observed flow of the integral meteor luminosity along its path can be explained theoretically by calculations of the emission lines of ionized and neutral elements under the assumption that the number of luminescent atoms is proportional to the dynamic pressure and the radius of the meteoric body. Transl. by G.G.

N65-23576# McGill Univ., Montreal (Quebec). Mechanical Engineering Research Labs.
THE STREAMWISE DEVELOPMENT OF CERTAIN TWO DIMENSIONAL TURBULENT SHEAR FLOWS
I. S. Gartshore 21 Apr. 1965 70 p refs
(Grant DRB-9551-12)
(Rept.-65-3)

Two-dimensional, incompressible, turbulent free jets, wall jets and wakes are investigated experimentally and theoretically. The analytical technique is based on Townsend's large eddy energy equilibrium hypothesis and provides an expression for the turbulent shear stress at a particular nondimensional ordinate in terms of local mean flow properties and two empirical constants. The analysis predicts mean flow development with reasonable accuracy. The small increment jet is not like the small deficit wake, a typical nondimensionalized shear stress being nearly twice as high in the wake as in the corresponding jet. No reason for this dissimilarity was found. Longitudinal turbulence intensity was measured at several streamwise locations in two nearly self-preserving wakes. The distributions show that the wakes are approaching a condition of turbulent self-preservation. Measurements of shear stress at one streamwise position in each wake compare favorably with distributions calculated from the momentum integral equation and the measured mean flow development. Author

N65-23650# Advisory Group for Aeronautical Research and Development, Paris (France).
RECENT DEVELOPMENTS IN BOUNDARY LAYER RESEARCH, PART III
May 1965 122 p refs Presented at the Specialists' Meeting, Naples, 10–14 May 1965
(AGARDOGRAPH-97)

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2. THEORETICAL AND EXPERIMENTAL STUDIES OF HYPERSONIC VISCOUS EFFECTS C. H. Lewis and J. D. Whitfield p 63–119 refs (See N65-23652 13-12)

N65-23651 ARO, Inc., Arnold Air Force Station, Tenn.
BOUNDARY-LAYER TRANSITION UNDER HYPERSONIC CONDITIONS
J. Leith Potter and Jack D. Whitfield *In* AGARD Recent Develop. in Boundary Layer Res. May 1965 p 1–61 refs (See N65-23650 13-12)
(Contract AF 40(600)-1000)

The purpose is to present a current discussion of experimental data concerning the dependence of boundary-layer transition upon certain factors. In general, hypersonic conditions are considered, and the data presented correspond to free-stream Mach numbers up to 18. Results indicate that the pronounced tendency for Reynolds number of transition to increase with Mach number (all else equal and $M_\delta > 3$) continues at least to $M_\delta = 8.5$ on both sharp-nosed cones and plates. The more stable boundary-layer flow on cones than on plates, remains in evidence but appears markedly diminished when M_δ increases toward 8.5. The problem of defining local flow conditions for boundary-layer analysis on slightly blunted bodies is emphasized. New data showing the size of roughness necessary to trip laminar boundary layers with M_δ up to 8.5 are incorporated. This report includes comparison of laminar- and turbulent-flow theories with corresponding experimental data. Data are presented which indicate that a boundary layer which appears to have been tripped by roughness, according to both appearance in shadowgraphs and changed thickness, actually may not cause heat-transfer rate to rise to the level of fully turbulent flow. Author

N65-23652 ARO, Inc., Arnold Air Force Station, Tenn.
THEORETICAL AND EXPERIMENTAL STUDIES OF HYPERSONIC VISCOUS EFFECTS
Clark H. Lewis and Jack D. Whitfield *In* AGARD Recent Develop. in Boundary Layer Res. May 1965 p 63–119 refs (See N65-23650 13-12)
(Contract AF 40(600)-1000)

The effects of viscous interaction and transverse curvature on the heat transfer and pressure distributions and zero-lift drag are presented for a 9° spherically blunted cone with a nose-to-base radius ratio of 0.3 at $M_\infty = 9$ and 18 over a range of Reynolds numbers. The effects of viscous interaction are obtained by iterating the viscous (boundary layer) and the inviscid (characteristics) flow fields. Comparisons are given with available experimental data which, in general, show good agreement with the predicted pressure distributions. The experimental heat-transfer data are in good agreement with the predictions including viscous interaction but without transverse curvature. With transverse curvature included, predictions overestimate the heat-transfer rate about 15%. The predicted drag is approximately 17% below the mean of the experimental drag data. An experimental shock layer pitot profile is compared with boundary-layer and characteristics solutions at one location on the cone at $M_\infty = 18$. The effects of shock-generated external vorticity are neglected; however the effects on the pitot profile data are discussed. Author

N65-23674*# National Aeronautics and Space Administration, Washington, D. C.
DESORPTION IN VACUUM [LA DESORPTION SOUS VIDE]

A. Schram Apr. 1965 35 p refs Transl. into ENGLISH from Le Vide, no. 103, 1963 p 55–68
(NASA-TT-F-9332) CFSTI: HC $2.00/MF $0.50

A general survey is given of present knowledge in this field. Important discrepancies between experimental results and theoretical explanations put forward by the different authors are pointed out. The complexity of the phenomenon is emphasized, and the relative importance of the different elementary process is discussed. A limited choice of research is proposed for desorption in vacuum. Theoretical calculation based on simplified models is compared with some experimental results. It is stipulated that the true surface area must be known; a simple experimental method for measuring this surface is described. The experimental curves of desorption are discussed taking account of preliminary results of true surface area measurements. In unbaked systems the absorbed gas layers at the surface are proved to yield the most important part of the total desorption rate. The residual desorption of baked systems in ultrahigh vacuum techniques seems more likely to be a bulk (diffusion, permeation) rather than a surface phenomenon. Analysis by mass spectrometers such as the omegatron is recommended. Author

N65-23698*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
JET PENETRATION INTO A LIQUID
H. G. Struck 8 Mar. 1965 41 p refs
(NASA-TM-X-53214) CFSTI: HC $2.00/MF $0.50

The study is restricted to the case of a round gas jet of subsonic and supersonic velocities penetrating liquid at right angles. The phenomenon was analyzed from two viewpoints. The first, a stagnation pressure analysis, related the depth of the surface depression or cavity to the stagnation pressure based on the centerline velocity of the jet in the neighborhood of the surface. The second, a displaced liquid analysis which takes the mixing process of the jet into account, related the weight of the liquid displaced from the cavity to the momentum of the jet. It was attempted to derive scaling laws from these investigations to predict penetration depth of full-scale rocket motors of space vehicles launched from platforms built over a water surface. Splash heights were also analyzed and correlated. Author

N65-23714*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIGITAL DISTRIBUTED PARAMETER MODEL FOR ANALYSIS OF UNSTEADY FLOW IN LIQUID-FILLED LINES
Don J. Wood, Robert G. Dorsch, and Charlene Lightner Washington, NASA, May 1965 49 p refs
(NASA-TN-D-2812) CFSTI: HC $2.00/MF $0.50

A distributed parameter model for computing unsteady flow conditions in liquid systems is presented. The model is adapted for use in conjunction with a digital computer. The analytical method employed is essentially a solution synthesized from the effects of incremental step pressure pulses. The pressure pulses are generated because of incremental flow rate changes that originate in a fluid system from a variety of sources, including the mechanical motion of the system structure. The pressure pulses propagate throughout the system at sonic velocity and are partially transmitted and reflected at each discontinuity. The velocity change caused by each pressure pulse is obtained from the relation for the characteristic acoustic impedance. Pressure and velocity time histories at any point in the system are obtained by a timewise summation of the contributions of the incremental pressure pulses passing that point. The analysis is presented in a form general enough to be applied to a variety of liquid-filled fluid systems. Author

N65-23747# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
PERIODIC BOUNDARY LAYER FLOWS OVER A FLAT PLATE, PART II
V. O'Brien and F. E. Logan Feb. 1965 94 p refs
(Contract NOw-62-0604-c)
(TG-658; AD-462336)

The parallel laminar flow theory number

$$\eta_0 = \left(\frac{\omega}{2\nu}\right)^{1/2} y_0$$

was verified as a similarity parameter by varying ω the oscillation frequency, ν the kinematic viscosity, and y_0 the plate separation distance. The oscillating plate generates horizontal pressure gradients within the flow so the flow pattern is not that of the classic zero pressure gradient theory. Measurements and displacements predicted by theory show good agreement. Author

N65-23768# Los Alamos Scientific Lab., N. Mex.
NUMERICAL FLUID DYNAMICS USING THE PARTICLE-AND-FORCE METHOD. PART I: THE METHOD AND ITS APPLICATIONS. PART II: SOME BASIC PROPERTIES OF PARTICLE DYNAMICS
Bart J. Daly, Francis H. Harlow, James E. Welch, and Everett E. Sanmann et al 8 Apr. 1965 167 p refs
(Contract W-7405-ENG-36)
(LA-3144) CFSTI: $5.00

This report discusses a number of properties of the particle and force method from conceptual, practical, and experimental points of view. The procedure as now applied is given in detail. Results of experimental calculations, conclusions, and a discussion of extensions being developed are included. The meaning of the particle representation of fluid dynamics is investigated through a close examination of some pertinent idealized computer experiments. Author

N65-23795*# National Aeronautics and Space Administration, Washington, D. C.
BEHAVIOR OF AN EXHAUST GAS TURBINE IN STEADY FLOW [VERHALTEN EINER ABGASTURBINE BEI STETIGER STROMUNG]
Takashi Yano May 1965 7 p Transl. into ENGLISH from Motortech. Z. Rundschau (Germany), v. 26, no. 1, 1965 p 29–30
(NASA-TT-F-9362) CFSTI: HC $1.00/MF $0.50

The exhaust gas turbine operates under conditions of pulsating flow. With experiments, it was shown possible to use the characteristic curves for continuous flow as boundary conditions for the operational behavior of the exhaust gas turbine. Various problems under conditions of continuous flow are treated. Author

N65-23815*# General Dynamics/Astronautics, San Diego, Calif.
DIGITAL ANALYSIS OF LIQUID PROPELLANT SLOSHING IN MOBILE TANKS WITH ROTATIONAL SYMMETRY
D. O. Lomen Washington, NASA, May 1965 38 p refs
(Contract NAS8-11193)
(NASA-CR-230) CFSTI: HC $2.00/MF $0.50

The hydrodynamic forces and moments derived for tanks possessing a longitudinal axis of symmetry are given in terms of coefficients which depend only on the tank geometry. This report explains the steps used to obtain these coefficients, given the tank geometry, and the procedures used in the program checkout. A description of the routines used in the program is included, as well as instructions for use of the program.

The output of the digital program gives the spring-mass parameters associated with the system. Author

N65-23855# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena

GAS ENTRAINMENT EFFECTS ON CAVITATION NUMBER IN MERCURY IN 1/2" VENTURI TO 400° F

F. G. Hammitt, M. J. Robinson, D. J. Kemppainen, and R. A. Robinson Apr. 1965 30 p refs

(Contract N41S6BA-002006)

(Rept.-06110-7-I)

A series of cavitation number versus gas content tests in dry mercury, using a 1/2-in. throat diameter stainless steel venturi, are reported. Tests were conducted at room temperature, at ~270° F, and at ~400° F using the throat velocity (34 ft/sec). Several pressure profiles were measured over a gas content range (for argon) between ~0.2 and ~4.0 ppm (by mass). Among the results reported are these: (1) the effect of gas content upon cavitation initiation number appears to be relatively small between the minimum attainable gas (~0.2 ppm) and ~2 ppm of argon, but becomes a factor of ~×2 or more for gas contents in the 3- to 4-ppm range. This was demonstrated for mercury temperatures ranging from room temperature to about 400° F at a single velocity and in the steel venturi; (2) gas volumetric rather than mass affects control; and (3) inconsistencies between data and theoretical expectations resulted partially from an inadequate definition of cavitation initiation. This can be largely remedied by referring cavitation number measurements to a constant loss coefficient basis. A curve showing rough correction factors derived from data for one velocity, size, and gross geometry over the full temperature range to 400° F for estimating the effect of gas content on cavitation initiation number is included. S.C.W.

N65-23899# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transfer Phenomena

GAS BUBBLE ENTRAINMENT IN WATER AND MERCURY VERSUS GAS CONTENT Internal Report No. 6

M. J. Robinson and F. G. Hammitt Jan. 1965 33 p refs

(Contract N41S6BA-002006)

(Rept.-06110-6-I)

The experiment described involved photographs of flow of water and mercury with entrained gas to obtain data on visible bubble sizes and visible gas content for known loop operating parameters and known total gas content. From a comparison of the estimated visible gas content and the known total gas content, conclusions are drawn about the distribution between dissolved and entrained gas. Conclusions are also presented regarding smallest visible bubble sizes, average mean observed sizes in both fluids, and homogeneity of the gas distribution in the fluids. Author

N65-24040*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

THE TRANSPORT PROPERTIES OF A MODERATELY DENSE LENNARD–JONES GAS

C. F. Curtiss, Michael B. Mc Elroy, and David K. Hoffman 1 May 1964 29 p refs

(Grant NsG-275-62)

(NASA-CR-56904; WIS-TCI-46) CFSTI: HC $2.00/MF $0.50

First- and second-order density corrections to the transport coefficients of a gas of Lennard–Jones molecules are evaluated numerically. The results are based on the formal kinetic theory development of Snider and Curtiss as later modified by Snider and McCourt. This treatment, in turn, is based on the modification of the Boltzmann equation suggested by Green. This modification is an approximation to the series development of Bogolubov and Hollinger and Curtiss. The numerical methods used in the evaluation of the various integrals are discussed. The effect of three body collisions on the first density correction term is considered approximately through a generalization of the Enskog rigid sphere expression. Author

N65-24041*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

THE DENSITY EXPANSIONS OF THE TRANSPORT COEFFICIENTS

David K. Hoffman 15 May 1964 40 p refs

(Grant NsG-275-62)

(NASA-CR-56919; WIS-TCI-48) CFSTI: HC $2.00/MF $0.50

The theory of transport phenomena in a gas is considered from a statistical mechanical viewpoint. The theory is based on the Liouville equation for the time evolution of an ensemble of systems and the B.B.G.K.Y. (Bogoliubov, Born, Green, Kirkwood, and Yvon) equations which are integrals of the Liouville equation. The B.B.G.K.Y. hierarchy is truncated by a factorization principle which is a generalization of the molecular chaos assumption. For purely repulsive potentials, the set of equations obtained by truncating at $f^{(3)}$ is shown to give rise to the three-body interaction term obtained by Hollinger and Curtiss and by a different argument by Bogolubov. The two coupled equations obtained by truncating the B.B.G.K.Y. hierarchy at $f^{(3)}$ are considered in detail. An approximation to these equations leads to a Boltzmann equation which is a soft potential generalization of the Enskog dense-gas equation for rigid spheres. This Boltzmann equation includes both collisional transfer and three-body collision effects. The equation is solved, and expressions for the transport coefficients based on this solution are obtained. Author

N65-24077# ARO, Inc., Arnold Air Force Station, Tenn.

THE USE OF BOUNDARY-LAYER SUCTION FOR MAINTAINING LAMINAR FLOW DOWNSTREAM OF A REFLECTED INCIDENCE SHOCK WAVE ON A FLAT PLATE AT FREE-STREAM MACH NUMBERS 2.5, 3, AND 3.5

S. R. Pate Arnold Eng. Develop. Center, May 1965 26 p refs

(Contract AF 40(600)-1000)

(AEDC-TR-65-81; AD-462130)

Tests were conducted in a 40-in. supersonic tunnel to determine the effectiveness of boundary-layer suction for maintaining laminar flow downstream of a reflected incidence shock wave on a flat plate. Test Mach numbers were 2.5, 3, and 3.5, and the Reynolds number (based on the boundary-layer rake location) ranged from 2.3 to 26.2 million. With suction, laminar flow was maintained downstream of a two-dimensional reflected incidence shock wave for shock generator angles up to 5° for all test Mach numbers. Author

N65-24078# ARO, Inc., Arnold Air Force Station, Tenn.

AN ANALYSIS OF TWO-DIMENSIONAL LAMINAR AND TURBULENT COMPRESSIBLE MIXING

R. C. Bauer Arnold Eng. Develop. Center, May 1965 22 p refs

(Contract AF 40(600)-1000)

(AEDC-TR-65-84; AD-462207)

The analysis is concerned with development of theoretical expressions for the mixing similarity parameters. A general momentum equation is derived, which relates the similarity parameter to the mixing length and viscous shear stress. By using this general equation and Newton's viscous shear relation, a complete theoretical solution for the laminar mixing

similarity parameter is derived, which does not involve a reference perturbation velocity factor. Prandtl's mixing length theory for the apparent viscous shear relation is used to obtain the theoretical similarity parameter for turbulent mixing. Based on these similarity parameters, equations for the width of the corresponding mixing regions are derived. These results and the approximate theoretical velocity profile equation developed by Pai, Nash, and Korst represent a closed-form theoretical approximation of the type of mixing considered. Author

N65-24079# ARO, Inc., Arnold Air Force Station, Tenn.
THEORETICAL AND EXPERIMENTAL STUDIES OF HYPERSONIC VISCOUS EFFECTS
Clark H. Lewis and Jack D. Whitfield Arnold Eng. Develop. Center, May 1965 61 p refs Presented at AGARD Fluid Dyn. Panel Specialists' Meeting, Naples, 10–14 May 1965
(Contract AF 40(600)-1000)
(AEDC-TR-65-100; AGARDograph-97, Pt. III; AD-462717)

The effects of viscous interaction and transverse curvature on the heat-transfer and pressure distributions and zero-lift drag are presented for a 9° spherically blunted cone with a nose-to-base radius ratio of 0.3 at $M\infty = 9$ and 18 over a range of Reynolds numbers. The effects of viscous interaction are obtained by iterating the viscous (boundary layer) and the inviscid (characteristics) flow fields. Comparisons are given with available experimental data which, in general, show good agreement with the predicted pressure distributions. The experimental heat-transfer data are in good agreement with the predictions including viscous interaction but without transverse curvature. Including transverse curvature, the heat-transfer rate is overestimated about 15%. The predicted drag is approximately 17% below the mean of the experimental drag data. An experimental shock layer pitot profile is compared with boundary-layer and characteristics solutions at one location on the cone at $M\infty = 18$. The effects of shock-generated external vorticity are neglected; however, the effects on the pitot profile data are discussed. Author

N65-24129* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ON AN EXTENSION OF OSWATITSCH'S EQUIVALENCE RULE TO UNSTEADY FLOW
M. F. Platzer *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. no. 1 1 Oct. 1964 p 33–43 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

This paper outlines an approximation theory for calculation of the linearized subsonic and supersonic flow around pulsating bodies of low aspect ratio, extending K. Oswatitsch's and F. Keune's theories for steady flow to these unsteady flow cases. In a first approximation, the flow around pulsating bodies of low aspect ratio consists of a two-dimensional cross-flow, and a spatial influence which depends only on the sum of the source-elements over the cross section. This spatial influence reduces the flow over pulsating low aspect ratio wings to the flow over the equivalent pulsating body of revolution. A similarly characteristic structure of the flow field is found also for the higher order flow terms. In addition to the basic conditions for linearization, the range of validity of this approximation theory is essentially bound by certain combinations of aspect ratio, Mach number, and reduced frequency. These order of magnitude considerations can be further substantiated by comparing the approximation theory with certain exact solutions of the unsteady linearized potential equation. Such solutions are found for the infinitely long tube or ribbon pulsating harmonically in subsonic or supersonic flow. Author

N65-24138* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SURFACE PROPERTIES OF TURBULENCE IN THE BOUNDARY LAYER
Hans A. Panofsky (Pennsylvania State Univ.) *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 100–103 (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

Presented is a discussion on wind variations in the surface boundary layer where the vertical variation of stress is negligible. Relationships between mean wind speed profiles, gust factors, and standard deviations and spectra of horizontal wind components (lateral and longitudinal) are discussed as a function of stability and terrain conditions. Author

N65-24205# IIT Research Inst., Chicago, Ill. Technology Center
PHASE EQUILIBRIA OF DRY AIR AT LOW PRESSURE
R. A. Budenholzer and G. Walker Wright-Patterson AFB, Ohio, ARL, Jan. 1965 76 p refs
(Contract AF 33(657)-11324)
(ARL-65-1)

Phase equilibria for an oxygen–nitrogen mixture equivalent to dry air (21 percent oxygen and 79 percent nitrogen) have been computed for the temperature range 65° to 35.61° K. Dew-point and bubble-point pressures for the mixture were evaluated by extending the data of previous investigators through their intersection with the previously established liquid–solid phase boundaries and into the sublimation region. The thermodynamic consistency of the methods employed in making the computations is established and their consistency checked in a region just above 65° K, where accurate experimental information is available. The composition of the vapor measured experimentally did not correlate with the composition predicted theoretically. Author

N65-24206# Ohio State Univ., Columbus. Aerodynamic Lab.
AN EXPERIMENTAL INVESTIGATION OF THE SURFACE PRESSURE DISTRIBUTION ON A CYLINDRICALLY BLUNTED FLAT PLATE AT MACH NUMBERS OF 10 AND 16 Final Technical Report
W. Burggraf and R. J. Shanahan Wright-Patterson AFB, Ohio, ARL, Mar, 1965 40 p refs
(Contract AF 33(657)-8106)
(ARL-65-45; AD-615007)

A cylindrically blunted flat plate was tested in a 30-inch hypersonic wind tunnel at M = 16 and at Reynolds numbers from 3000 to 25000 based on leading edge diameter. The flat plate was equipped with interchangeable leading edges of 1/8-, 1/4-, and 1/2-inch diameter to examine this range of Reynolds numbers and to allow pressure measurements to S/D = 100. Angle of attack was varied from 0° to 10° compression for the test sequence. In addition, surface pressure data were obtained on a 1/8-inch thick flat plate in a 12-inch hypersonic wind tunnel at M = 10 and Reynolds numbers ranging from 600 to 1200 based on leading edge diameter. Angle of attack was varied from 10° expansion to 10° compression for the test sequence. Author

N65-24265# British Aircraft Corp., Preston (England).
THE TURBULENT SUPERSONIC BASE PRESSURE PROBLEM. A COMPARISON BETWEEN A THEORY AND SOME EXPERIMENTAL EVIDENCE
H. McDonald Apr. 1965 32 p refs
(Contract KU/4/025/C.B.10(a))
(Ae-194)

The theory is based on the Chapman–Korst flow model of separated flows with a modified recompression process. Due allowance can be made for the presence of the initial boundary layer, with the limitation that its thickness must be less than about one step height at low Mach numbers, dropping to about one third of a step height at M =3.0. Fairly good agreement between the predicted and measured base pressure can be obtained although a predicted Reynolds number effect is not observed. The absence of this Reynolds number effect is discussed in the light of recent experiments on flow mixing. Author

N65-24323# Atomic Weapons Research Establishment, Aldermaston (England).
INTERFACE INSTABILITY UNDER VARIABLE NORMAL ACCELERATION
I. G. Cameron and H. H. M. Pike Feb. 1965 24 p refs
(AWRE-0-96/64)

Layzer's treatment was extended to variable acceleration in what is considered a good approximation, and to the two fluid case in a plausible manner. The treatment is limited to high accelerations of low viscosity, incompressible fluids. Author

N65-24326# Royal Aircraft Establishment, Farnborough (England).
THE EXPERIMENTAL MEASUREMENT OF THE ABSORPTION CAPACITY OF AIR BEHIND THE FRONT OF A SHOCK WAVE [EKSPERIMENTAL'NOE IZMERENIE POGLOSHCHATEL'NOI SPOSOBNOSTI VOZDUKHA ZA FRONTOM UDARNOI VOLNY]
S. A. Losev and N. A. Generalov Dec. 1964 7 p ref Transl. into ENGLISH from Fiz. Probl. Spektroskopii (Leningrad), v. 1, 4–12 Jul. 1960 p 114–116
(RAE-LIB-TRANS-1086)

The absorption capacity of air at a pressure of 1 atm and heated to temperature between 2500° and 4000° K in a 2-inch-diameter shock tube was measured in a narrow wavelength region near 2200 Å by means of absorption spectroscopy. It is shown that at this wavelength and at a temperature of 3600° K, the absorption is mainly in the Schumann–Runge O_2 bands and is not due to NO; this result makes the study of O_2 dissociation behind shock wave in air possible. Author

N65-24389# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
FLOW SEPARATION IN HIGH SPEED FLIGHT: A REVIEW OF THE STATE-OF-THE-ART
J. E. Wuerer and F. I. Clayton Apr. 1965 130 p refs
(SM-46429)

A physical explanation is given of two types of flow separation classified as boundary layer separation and breakaway separation. A short discussion of the fluid dynamic complexity of the problem is presented. Such characteristics of separated flows as the pertinent descriptive parameters, state of flow, length of separated region, compression process, flow steadiness, and three-dimensional effects are discussed. The effects of flow separation on the pressure, skin friction, and heat transfer distribution are described, and a review of semiempirical methods for calculating the critical overall pressure rise, the geometry of the separated region, and the heat transfer at reattachment is presented. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N65-23575 Academy of Sciences (USSR), Moscow. Astronomical Council
A GRAPHICAL METHOD FOR DETERMINING THE HEIGHT OF THE SHADOW ABOVE THE SURFACE OF THE EARTH [GRAFICHESKIY METOD OPREDELENIYA VYSOTY TENI NAD POVERKHNOST'Y ZEMLI]
V. A. Vorotnikov *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 39 Jun. 1964 p 19–21 In RUSSIAN (See N65-23568 13-07)

A graphic method for determining the altitude of the boundary of the earth's shadow above any point on the surface of the earth is presented. This determination is of importance because sunlight at the satellite altitude is necessary for satellite observations. A graphic representation of smoothed shadow data is presented. Orbital data from photographic observations of various satellites at various stations are tabulated. M.P.G.

N65-23600# McGill Univ., Montreal (Quebec). Dept. of Meteorology
ATMOSPHERIC KINETIC ENERGY AT 500 mb AS A FUNCTION OF ZONAL WAVE NUMBER
F. M. Luistro Dec. 1964 69 p refs *Its* Publ. in Meteorology No. 73 Sponsored by the Meteorol. Serv. and Foreign Aid Office, Can.

Atmospheric kinetic energy computations at 500 mb are done for both hemispheres, except the tropical zone on a daily basis during September 1 through 30, 1957. The basic computational elements are the geopotential-height grid point values taken at every 5° latitude and at every 10° longitude. Fourier analysis techniques are employed to determine the kinetic energy spectra as a function of zonal wave numbers. Comparative analysis of the energy profiles of the two hemispheres shows that the total kinetic energy is greater in the Southern Hemisphere; the zonal flow energy of the Southern Hemisphere is roughly three times that of the Northern Hemisphere, while their mean perturbation energies are approximately of the same magnitude; and the mean zonal energy is greater than the mean perturbation energy in the Southern Hemisohere and vice versa in the Northern Hemisphere. Author

N65-23609# Royal Aircraft Establishment, Farnborough (England).
TERMINAL VELOCITIES OF WINDOW DIPOLES USED IN HIGH ALTITUDE WIND MEASUREMENTS
T. W. G. Dawson Nov. 1964 26 p refs
(RAE-TR-64049)

Various theoretical formulas for the rate of fall of window dipoles at altitudes up to 100 km are shown in agreement with the best available experimental data. At low altitudes velocity is determined mainly by conventional aerodynamic drag. At approximately 20 km, Lamb's theory of viscous flow is required while at 50 to 70 km, corrections must be applied for slip flow. Above about 75 km, free molecule flow theory is needed to get good agreement with experiment. For the most accurate measurements of wind structure it is desirable to employ dipoles with the smallest possible terminal velocity. This means that the dipoles should have low density and the smallest possible thickness. Author

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N65-23620# Sandia Corp., Albuquerque, N. Mex. Health Physics Div.

FALLOUT REPORT: BETA-GAMMA RADIOACTIVITY IN AIR AT SANDIA LABORATORY JULY THRU DECEMBER 1964

R. E. Womelsduff Apr. 1965 14 p refs Sponsored by AEC (SC-RR-65-184) CFSTI: $1.00

Filters were run continually, except as noted. Gaps in data are due to such factors as power failures and rain wetting the filter, causing it to tear. The air samples were collected on 4-inch Staplex TFA #2133 dust filters in a high-volume air sampler. Airflow through the filters averaged around 50 cubic feet per minute for the two samplers used. Running periods during the week were generally 24 hours, and about 72 hours over the weekend. The filters were counted in a flat-plate thin-window gas-flow counter having an efficiency of about 44% for beta from Sr^{90}–Yr^{90}. The counter was calibrated with a 0.23-microcurie Sr^{90}–Yr^{90} source deposited on a 4-inch round plastic disc. Filters were counted after a 5-hour decay and after a 7-day decay. The count and airflow rates were converted to give a value in micromicrocuries per cubic meter ($\mu\mu C/M^3$) of airflow through the filter. The 7-day decay data are plotted on the accompanying graph. Author

N65-23624*# National Aeronautics and Space Administration, Washington, D. C.

VARIATIONS OF COSMIC RAY INTENSITY IN PASSING CYCLONES [VARIATSII KOSMICHESKIKH LUCHEY PRI PROKHOZHDENII TSIKLONOV]

N. P. Chirkov 18 Jul. 1962 5 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. II, no. 3, 1962 p 570–571

(NASA-TT-F-8260) CFSTI: HC $1.00/MF $0.50

Seven cases of developing cyclones in Moscow during the period 1952 to 1953 were analyzed to determine the effect of passing cyclones on variations in cosmic-ray intensity. The total period marking the passage of the cyclone was divided into 19 zones, and temperature deflections from the average were found for each zone at the level corresponding to the investigated period, using standard isobaric levels. The obtained temperature variation epochs were superimposed to obtain averages. The hourly values of the global intensity of the hard component of cosmic rays, corrected for the barometric pressure at Moscow, were processed by a similar method. The mean variation of cosmic-ray intensity was found to drop by 0.3% to 0.4% at the passage of the warm front of the cyclone, followed by a minimum variation ahead of the cold front, followed by an increase of 0.7% to 0.8%. A correlation coefficient of 0.79 was obtained between the experimental and theoretical data. M.P.G.

N65-23662*# Pennsylvania State Univ., University Park.

ELECTRON DENSITIES AND TEMPERATURES IN THE F-REGION FROM BACKSCATTER MEASUREMENTS AT ARECIBO

H. C. Carlson and J. S. Nisbet [1965] 16 p

(Grant NsG-134)

(NASA-CR-62663) CFSTI: HC $1.00/MF $0.50

The diurnal variation in electron densities and temperatures in the F-region above Arecibo, Puerto Rico, is discussed. The morning buildup and nighttime decay of temperatures on several summer and winter days is presented as a function of height; and possible explanations are given for the seasonal differences. Up to 375 km the ion temperatures appeared to be in good agreement with estimates of the neutral-particle temperatures except for a period of several hours after sunrise when significant departures were observed in the region of 300 km. Electron temperatures were generally observed to be about three times the ion temperatures during the day and to have a rather irregular behavior from day to day. During the night, ratios of electron-to-ion temperatures, in excess of 1.2, were observed at all times in the region of the F_{max}. Author

N65-23709* Hawaii Inst. of Geophysics, Honolulu.

A SUMMARY OF ONE YEAR OF OBSERVATIONS OF 6300A AIRGLOW AT HALEAKALA

F. E. Roach, W. R. Steiger, and W. E. Brown Sep. 1964 119 p refs

(Grant NsG2135-61)

(NASA-CR-60268; HIG-64-16) CFSTI: HC $4.00/MF $0.75

This paper summarizes more than a year of observational data on the 6300 A emission made at the tropical station at Haleakala (geographic latitude N 20° 42'43", geographic longitude W 156° 15'47", magnetic latitude 20°50' N, magnetic longitude 88°27' W, altitude 10012 feet or 3052 meters, A.S.L. on the island of Maui, Hawaii). A general description is given of the observations with particular emphasis on the marked intensity enhancements which have frequently occurred. Author

N65-23712*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

DETERMINATION OF THE ELLIPTICITY OF THE EARTH'S EQUATOR FROM OBSERVATIONS ON THE DRIFT OF THE SYNCOM II SATELLITE

Carl A. Wagner Washington, NASA, May 1965 70 p refs

(NASA-TN-D-2759) CFSTI: HC $3.00/MF $0.75

An original, simple theory is presented for the radial and longitudinal drift regime, in a triaxial earth-gravity field, of an inclined 24-hour satellite with a near-circular orbit. This new theory shows that the inclined orbit regime is the same as the equatorial, modified only by an inclination factor. The theory is closely validated by two numerically integrated particle drifts of about 3-months duration each. The particle program included best estimates of sun and moon gravity, longitude-independent (zonal) earth gravity through fourth order, as well as triaxial earth gravity (associated with equatorial ellipticity). On the basis of this validation, the actual drift of Syncom II over Brazil is reduced to yield the following two parameters of the earth's equatorial ellipticity:

$$J_{22} = -(1.70 \pm 0.05) \times 10^{-5}$$

(representing a 65 ±2 meter difference between major and minor equatorial radii); and $\lambda_{22} = -(19 \pm 6)^{\circ}$ (locating the geographic longitude of the major equatorial axis). These results show a somewhat stronger and west-shifted equatorial ellipticity than recent geodetic investigations in 1963–1964 indicate. Author

N65-23731# Societa Ricerche Impianti Nucleari, Saluggia (Italy).

CONTRIBUTION TO THE UNDERSTANDING OF NATURAL EVOLUTION OF PETROLEUM RADIATION EFFECTS ON CRUDE OILS

Umberto Colombo, Ennio Denti, Giuseppe Sironi (Montecatini Co., Novara, Italy), and Edoardo Zimmer [1964] 29 p refs Presented at the 3d U. N. Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 31 Aug.–11 Sep. 1964

Irradiation experiments were performed on some crude oils both alone and in the presence of different sedimentary rocks and water, in environmental conditions similar to those for sedimentary basins. Vials and a device programed for the

withdrawal of gaseous radiolytic products were used. Considerable radiation effects on structure, composition, and distribution of molecular weights of irradiated crudes were found. Complex condensed molecules and gaseous products were formed. Irradiations in the presence of certain natural catalysts, particularly when water wet, lead to the formation of fewer hydrogen and unsaturated molecules, than are obtained when crude oils are irradiated alone. Irradiations of crudes with water wet clay in the device programed for the removal of gas, allowed higher doses than the experiments performed in vials. With such doses a large amount of the oil becomes insoluble in $CHCl_3$. Thermogravimetric diagrams of the total solids have a pattern similar to those from a carbonaceous shale and a uraniferous asphaltite. Author

N65-23749# Navy Electronics Lab., San Diego, Calif.
THE OFFSHORE CIRCULAR ARRAY: TECHNIQUES FOR THE MID-WATER SUPPORT AND MOORING OF OCEANOGRAPHIC INSTRUMENTATION IN SHALLOW WATER
W. J. Bunton and I. E. Davies 19 Jan. 1965 26 p
(NEL-1261; AD-458582)

Techniques for the midwater support and mooring of oceanographic instrumentation in shallow water are discussed. Divers emplace stanchions in sediment of ocean floor with a jet of pressurized water. Accuracy of positioning is verified by radius and chord cables. Author

N65-23764# Bissett-Berman Corp., Santa Monica, Calif.
OCEANOGRAPHIC EXPERIMENTS FOR THE MANNED ORBITAL RESEARCH LABORATORY Final Report
15 Jan. 1965 97 p refs Prepared for Douglas Aircraft Co.
(C-155-1)

Five oceanographic experiments are outlined to determine the following: (1) the vertical distances of the ocean's surface as a function of the latitude and longitude; (2) the distribution on a synoptic basis over a wide area of the ocean and at many depths a set of oceanographic parameters such as salinity, temperature, sound velocity, pressure, current velocity, molecular oxygen, and nitrate-phosphate concentration; (3) the spectral distribution functions of temperature which relate the size of the temperature fluctuations with the horizontal scale distance over which these fluctuations take place, and the correlation of mean temperature to meteorological data; (4) the average values of salinity over areas of 30 to 50 miles across on a continuous basis; and (5) the color spectrum distribution of the reflected and scattered light from the upper layers of the ocean as a function of longitude and latitude.
E.E.B.

N65-23773# Public Health Service, Washington, D. C. Div. of Air Pollution
AIR POLLUTION PUBLICATIONS: A SELECTED BIBLIOGRAPHY, 1955-1963
Anna Grossmann-Cooper Washington, GPO, 1964 183 p *Its* Publ. No. 979, Rev. GPO: $1.00

N65-23806* National Aeronautics and Space Administration, Washington, D. C.
CONCERNING THE SOURCES OF THE INNER HEAT OF THE EARTH
E. A. Lubimova *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 111-126 refs (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

An analysis of the energetic effect of short-lived isotopes, the emission of heat in the process of the gravitational changeover of the earth, the hypothesis concerning the role of the neutrino, the emission of heat in the process of tidal friction, and new data concerning the mean content of uranium, thorium, and potassium in the earth, are presented in an attempt to determine the role of these factors in the thermal balance of the earth. It is concluded that the evolution of the earth was directed toward a gradual secular heating under the effect of heat of slowly disintegrating radioactive elements and possibly of the gravitational differentiation of the earth. S.C.W.

N65-23834*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy
THE INFLUENCE OF GEOMAGNETIC ACTIVITY ON POLAR CAP ABSORPTION
H. Leinbach, D. Venkatesan, and R. Parthasarathy (Alaska Univ.) Apr. 1965 51 p refs
(Grants NsG-233-62; NSF GP-947)
(NASA-CR-62739; SUI-65-11) CFSTI: HC $3.00/MF $0.50

Several polar cap absorption (PCA) events for which simultaneous riometer data exist for Thule, Greenland, and College, Alaska, are examined and compared with the ratio of absorption at the two stations. Comparison with other stations south and north of College is also made. Division of the polar cap into two regions is verified. In the first, including latitudes to the north of geomagnetic 65°, the progress of the PCA event is dominated by the time variations of the solar particle flux, and is essentially independent of the geomagnetic field variations. In the second zone, extending from geomagnetic latitudes of about 64° down to about 55°, the characteristics of the PCA are dominated by the influence of the geomagnetic field. Comparison of these results with satellite studies of the solar particles and with theoretical calculations of the absorption expected from protons with given exponential rigidity spectra, leads to the deduction of an effective cutoff at College of the order of 30 MeV or less, as observed by satellites in a few events. Author

N65-23843*# National Aeronautics and Space Administration, Washington, D. C.
THE UPPER LAYERS OF THE ATMOSPHERE [VYSOKIYE SLOI ATMOSFERY]
I. A. Khvostikov May 1965 585 p refs Transl. into ENGLISH from Gidrometeorol. Izd. (Leningrad), 1964
(NASA-TT-F-315) CFSTI: HC $8.85/MF $2.75

This book contains an exposition of contemporary scientific knowledge of the upper layers of the atmosphere. Methods of measurement with the aid of rockets and artificial Earth satellites are examined, as well as meteoric acoustical and radio measurement methods, searchlight probes of the atmosphere and observations of optical phenomena of the day, twilight and night sky. Results are cited of studies of the structure and composition of the stratosphere and still higher layers, as well as the results of investigations of winds, tidal phenomena, vertical and turbulent movements and circulation of the upper layers of the atmosphere based on observations of ozone, atomic oxygen and water vapor. The theoretical treatment of some phenomena and some atmospheric processes is presented. Considerable attention is given to the Earth-Sun problem, including questions of the effect of solar activity on atmospheric processes, to the structure of the upper layers of the atmosphere and to the connection between circulation processes and geomagnetic variations. Author

N65-23876# National Physical Lab., New Delhi (India). Radio Propagation Unit
IONOSPHERIC EFFECTS OF NUCLEAR EXPLOSIONS PART I: LOW ALTITUDE EXPLOSIONS Scientific Report No. 18

A. K. Saha and K. K. Mahajan 15 Dec. 1964 52 p refs (RPU-S-18)

Following atmospheric megaton range nuclear explosions only the D and F2 regions of the ionosphere were found to be affected. Effects on the D region could be observed as enhancement of atmospheric noise levels at 27 and 100 kc/s and increase of long wave field strength (164 kc/s), and occurred from within a few minutes to 2 hours after the explosions. The F2 region effects could be identified by foF2 enhancement on C-4 ionograms, and occurred within 3 hours after the explosions. From the observed D region effects it is concluded that the ionization enhancement of a nuclear detonation is more localized in height range than a solar flare SID. An analysis with true heights obtained from C-4 ionograms for several explosions shows an enhancement of electron density at all levels above 200 km. The maximum effect in the F2 layer is found to occur somewhat below the F2 peak. Author

N65-23878# National Physical Lab., New Delhi (India). Radio Propagation Unit

UPPER F-REGION PROFILES DURING LOW SOLAR ACTIVITY DERIVED FROM OBSERVATIONS ON FARADAY FADING OF SATELLITE TRANSMISSIONS Scientific Report No. 17

Y. V. Somayajulu, Tuhi Ram Tyagi, and V. P. Bhatnagar 30 Nov. 1964 26 p refs (RPU-S-17; SR&RA-5)

Results show that the upper bound of O^+ ion as a predominant constituent is 550 to 600 km. Above this level for nighttime H^+ ion is inferred to be the predominant constituent, giving a low transition altitude for O^+ to H^+ around 600 km. For daytime He^+ is taken to be the predominant lighter constituent whose thickness is taken to be one ionic scale height arbitrarily, above which H^+ ions predominate. These results are consistent with earlier rocket measurements of ion density profiles and the Alouette topside sounder results. This low transition altitude is interpreted in terms of a higher lighter ion concentration in the upper ionosphere. The consistently low value of total content obtained from model profiles could be interpreted by taking higher electronic and ionic temperatures or higher lighter ion concentration in the upper ionosphere or both. Author

N65-23883# International Geophysical Year World Data Center A, Washington, D. C.

CATALOGUE OF DATA IN WORLD DATA CENTER A: AIRGLOW, IONOSPHERE, AURORA (INSTRUMENTAL), AURORA (VISUAL), COSMIC RAYS, GEOMAGNETISM, SOLAR ACTIVITY, 1 JANUARY 1960–31 DECEMBER 1964

Washington, NAS, Jan. 1965 87 p refs

Airglow data listed are the results of photometric observations made for several wavelengths. The results of ionosphere observing programs are presented. Data are reported on vertical incidence soundings, ionospheric electron density, ionospheric drift, atmospheric radio noise, whistlers, miscellaneous, and backscatter. Aurora (instrumental and visual) data reported include (1) photographs taken with all sky cameras located mainly in the northern and southern auroral regions and (2) visual data, which is obtained in the sub-auroral and min-auroral belts by observers of the meteorological service. Data on the following apparatus used in cosmic ray observations are reported: ionization chamber, cubical Meson telescope, narrow-angle telescope, shower apparatus, underground telescope, and neutron monitor. Geomagnetism data from magnetograms and earth currents (tellurigrams) are presented. Solar activity data includes Wolf sunspot numbers, solar flare, bright and dark surges, and radio emission. S.C.W.

N65-23904*# National Aeronautics and Space Administration, Washington, D. C.

STRUCTURE OF THE EARTH'S IONIZED GAS SHELL ACCORDING TO DATA OF DIRECT MEASUREMENTS OF LOCAL CHARGED PARTICLE CONCENTRATIONS CONDUCTED IN THE USSR [STROYENIYE IONIZOVANNOY GAZOVOY OBOLOCHKI ZEMLI PO DANNYM PRYAMYKH IZMERENIY LOKAL'NYKH KONTSENTRATSIY ZARYAZHENNYKH CHASTITS PROVEDENNYKH V SSSR]

K. I. Grigauz Sep. 1962 23 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), v. 12, 1962 p 105–118

(NASA-TT-F-8278) CFSTI: HC $1.00/MF $0.50

Measurements of local concentrations of electrons and ions in the outer ionosphere over the F region of ionization maximum were carried out during the past 3 years in the Soviet Union at vertical launchings of geophysical rockets, aboard the third earth satellite; and by means of the first three cosmic rockets. The results of these measurements are used to construct an approximate vertical distribution of free electron and charge particle concentration for the period near the solar cycle maximum. The boundary of the ionosphere and its degree of change at various heights are included. R.C.S.

N65-23988* Litton Systems, Inc., St. Paul, Minn. Applied Science Div.

DIVINING FOR WATER IN STRATOSPHERE

Sheldon Steinberg *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 99–105 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Among instruments used to determine the quantity of stratospheric water vapor are spectroscopic devices, conductivity elements, electrolytic hygrometers, microwave refractometers, dewpoint–frostpoint hygrometers, gravimetric samplers, and the hair hygrometer. A brief description of these instruments is given and their potential discussed. Different investigators reported widely divergent amounts of water vapor for the same altitude regimes. In general, the values appear to have a similar pattern, that is, the mixing ratio decreases with altitude to about 16 km and then increases at least to highest point measured to date, 36 km. Author

N65-23989* Honeywell, Inc., St. Paul, Minn. Military Products Group Research Lab.

STRATOSPHERIC FROST-POINT MEASUREMENTS USING THE ALPHA RADIATION HYGROMETER

Stephen F. Rohrbough and John G. Ballinger *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 107–116 refs (See N65-23980 04-13) CFSTI: HC $6.00/MF $1.50

Associated with reliable frost-point measurements of the stratosphere are problems of proper instrument operation under low frost-point conditions and contamination from extraneous sources of water vapor. These problems are discussed and results of two night balloon flights presented. These flights had several models of alpha radiation hygrometer onboard. Results obtained indicate little difference between ascent and descent frost points. Present programs in this field are discussed. Author

N65-24038*# National Aeronautics and Space Administration, Washington, D. C.

ABSOLUTE CONCENTRATIONS OF THE EARTH ATMOSPHERE IONIC COMPONENTS IN THE 100–200 KM ALTITUDE RANGE [ABSOLYUTNYYE KONTSENTRATSII IONNYKH KOMPONENT ATMOSFERY ZEMLI NA VYSOTAKH OT 100 DO 200 KM]

V. G. Istomin 19 May 1962 7 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), v. 11, 1961 p 94–97
(NASA-TT-F-8225) CFSTI: HC $1.00/MF $0.50

Rocketborne mass spectrometric ion measurements and simultaneous electron concentration measurements by radiotechnical means were used to compile data on absolute concentrations of all ions with M = 14 (N^+), M = 16 (O^+), M = 28 (N_2^+, and possible Si^+ in the 100- to 200-km region), M = 30 (NO^+), and M = 32 (O_2^+). Ions with mass numbers 11 (B^+) and 12 (C^+) were also registered at 200-km altitude and attributed to rocket contamination. Rocket observations in July 1959 and June 1960 found ions with M = 18 (H_2O^+) at 200-km altitude in concentrations of $3 \cdot 10^{-3}$ cm^{-3}, and $2 \cdot 10^4$ cm^{-3}, respectively. The concentration of positive ions and electrons in the morning atmosphere of July 22, 1959, as well as in the evening atmosphere of September 9, 1957 is presented in tables. G.G.

N65-24063# Joint Publications Research Service, Washington, D. C.
A METHOD OF ELIMINATING THE INFLUENCE OF TOPOGRAPHY IN THE ALTERNATING-CURRENT CHARGE METHOD
M. N. Yegorov 19 May 1965 14 p refs Transl. into ENGLISH from Vestn. Leningrad. Univ., Ser. Geol. i Geogra. (Leningrad), v. 6, no. 1, 1965 p 64–72
(JPRS-30164; TT-65-31035) CFSTI: $1.00

The exclusion of the relief effect in topographic measurements of the variable magnetic field of a charged body, by means of measuring the inclined components of the vector of the magnetic field, is described. The inclined components may be either measured directly or calculated from the observations. The points at which vertical holes lie must be determined with the shape of the vertical plane perpendicular to the profile considered. Several examples of this method are included. G.G.

N65-24073# Geotechnical Corp., Garland, Tex.
GRAVITY AND MAGNETIC SURVEY OF THE AREA WITHIN AND SURROUNDING THE WICHITA MOUNTAINS SEISMOLOGICAL OBSERVATORY SEISMOMETER ARRAY
Technical Report, 1 Mar. 1963–30 Jun. 1964
1 Nov. 1964 53 p refs Revised
(Contract AF 33(657)-12007)
(TR-64-103; AD-452846)

A two-phase gravity and magnetic survey was made of the Wichita Mountains area of southwestern Oklahoma. Phase I was a vertical magnetic and gravity survey of the northwest corner of the Mt. Scott, 7.5′ quadrangle. Special emphasis was placed on the area included in the Wichita Mountains Seismological Observatory (WMSO) seismometer array. The area covered by the WMSO local surveys is approximately 5.5 square miles, with 208 gravity stations, and 89 magnetic stations. Phase II was a regional gravity and vertical magnetic intensity survey of the southwestern part of Oklahoma and a portion of northwest Texas. Seven traverses were made radiating from WMSO. The station spacing on these traverses was approximately 4 miles. The local magnetic survey showed a group of positive and negative anomalies which are unrelated to changes in lithology or structure. These anomalies are apparently due to local changes in the intensity of remanent magnetization. At least part of these changes are caused by the severe lightning discharges that occur frequently. The WMSO area gravity survey showed several small negative anomalies, apparently caused by granite and rhyolite filling of the eroded gabbroic surface. Author

N65-24106*# National Aeronautics and Space Administration, Washington, D. C.
IONS OF EXTRA-TERRESTRIAL ORIGIN IN THE EARTH'S IONOSPHERE [IONY VNEZEMNOGO PROISKHOZHDENIYA V IONOSFERE ZEMLI]
V. G. Istomin May 1962 18 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), v. 11, 1961 p 98–107 Presented at the 3d Space Sci. Symp., Washington, D. C., May 1962
(NASA-TT-F-8220) CFSTI: HC $1.00/MF $0.50

Radiofrequency mass-spectrometer observations from a rocket launch into the 92- to 206-km altitude range registered NO^+ and O_2^+ ions simultaneously with Mg^+ ions. An ion peak at M = 40 was identified as Ca^+ ions. High currents in the M = 56 region led to the assumption that great quantities of Fe^+ ions of the order of magnitude close to the Mg^+ concentration exist at about 101-km altitude. The occurrence of ions with M = 28 in the E-region was attributed to silicon ions Si^+. It was concluded that the presence of lines of ionized iron, magnesium calcium, and silicon is attributable to the ionization mechanism of fast-flying meteor matter atoms at their nonelastic collisions with the molecules of the atmosphere. G.G.

N65-24112*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
VARIATIONS OF GEOMAGNETIC ACTIVITY WITH LUNAR PHASE
Harold L. Stolov and A. G. W. Cameron 26 Mar. 1964 22 p refs Submitted for Publication
(NASA-TM-X-51678) CFSTI: HC $1.00/MF $0.50

Analysis of 31 years of K_p data suggests a genuine variation of geomagnetic disturbance with lunar phase. A broad increase in geomagnetic activity of about 4% begins half a day after full moon and lasts 7 days. A broad decrease in geomagnetic activity of about 4% is found for the 7 days preceding full moon. The results are verified by a study of random data and by an examination of quiet and disturbed periods. The effect is not found during periods of greatest disturbance. Author

N65-24121# Library of Congress, Washington, D. C. Aerospace Technology Div.
AMPLITUDE AND PHASE SPECTRA OF NEAR ATMOSPHERICS IN THE 2–30-KC RANGE [AMPLITUDNYYE I FAZOVYYE SPEKTRY BLIZKIKH ATMOSFERIKOV V DIAPAZONE 2–30 KGTS]
G. A. Mikhaylova 3 May 1965 8 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 5, no. 1, 1965 p 179–183
(ATD-T-65-22; AD-462419) CFSTI: HC $1.00/MF $0.50

One of the possible methods of determining the spectrum properties of lightning discharge—the spectrum of the dipole moment of the discharge—is the registration of atmospherics at rather short distances from the discharge. With the use of a theoretical complex propagation function for a flat earth-ionosphere model, the complex spectrum of dipole moment was calculated. The results of previous atmospheric observations at distance of 50 to 300 km from the source were used. The analysis showed that in a substantial majority of cases (70% to 80%) the signals were of positive polarity for a duration of 100 to 150 microsec. The results of the complete harmonic analysis are shown. E.E.B.

N65-24135* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A TOPOGRAPHICAL STUDY OF THE F_2 REGION OF THE IONOSPHERE

W. T. Roberts and L. G. Mc Donald *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 88–92 ref (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

Several aspects of the F_2 layer (the region of highest electron density) of the ionosphere are investigated. Contour maps of constant critical frequency of the F_2 peak, and height of the F_2 layer over the earth reveal a seasonal variability which may be predictable. Author

N65-24193# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics

SOME WAVE PROPAGATION PROBLEMS IN A BOUNDED, HETEROGENEOUS, ELASTIC MEDIUM

Glenn Converse Feb. 1965 122 p refs

(Grants DA-ARO(D)-31-124-G238; DA-31-124-ARO-D-223; NSF GK-47)

(SUDAER-216; AROD-4702-1; AD-614808)

This report studies relationships between the frequency, phase velocity, group velocity, and wave number of waves propagating in bounded, heterogeneous, linearly elastic media. Inherent mathematical difficulties preclude the possibility of analyzing all wave motions in detail. Two assumptions are introduced, with the result that the partial differential equations reduce to ordinary ones. One states that the elastic parameters are functions of one coordinate only. This coordinate is always normal to all bounding surfaces. The second requires that the waves are harmonic in the direction of propagation, which is always parallel to the bounding surfaces, and in time. For two wave systems studied, the emphasis is on determining the way in which the phase velocity varies with the wave number. From this relationship, the frequency and group velocity can be found as functions of the wave number. Author

N65-24222# Ionosphären-Institut Breisach (West Germany).

STATISTICS OF E-REGION DRIFT AT PUERTO RICO REDUCED BY THE "SIMILAR FADE" METHOD Annual Summary Report, 1963–1964

E. Harnischmacher and K. Rawer 15 Nov. 1964 50 p ref

(Contract AF 61(052)-672)

(IIB-13; AFCRL-65-245; AD-614670)

Three antenna records of E-region echoes obtained from 1954 to 1957 were evaluated by a tabulation method that establishes the drift from the time differences between corresponding fades on the three traces. Monthly statistical values were obtained by plotting the observed values of drift direction or drift velocity as functions of the local mean time. The probability distribution was determined and expressed in percent with the total number of plotted points for each hour considered. Intercomparison of these diagrams showed that the data of the same month in different years are not similar. The average probability distribution of drift direction during daytime was established as 180° (S.), and 320° (NNW) and the sense of rotation was established as S.–W.–N. Seasonal variations showed a 180° southern direction from October through March, and a northern direction between 300° and 90° from April through August. Representative monthly statistics of E-region drift direction and velocity are included. G.G.

N65-24229# Joint Publications Research Service, Washington, D. C.

AUTOMATIC INPUT AND OCEANOGRAPHIC DATA PROCESSING BY THE "URAL-2" COMPUTER

R. B. Dubina and Yu. V. Nikolayev 12 May 1965 7 p refs Transl. into ENGLISH from Tr. Inst. Okeanol. (Moscow), v. 75, 1964 p 69–72

(JPRS-30033; TT-65-30973) CFSTI: $1.00

Described is the automation of oceanological information processing by an electronic digital computer using special attachments to feed the information into the computer directly from the communication line. This attachment reads off a 5-digit telegraph code at the rate of 800 per second and records it in the short element of the operative memory of the computer. The volume of the free computer memory makes it possible to read and record approximately 4.5 meters of telegraph tape in a single operation. The machine verifies all water temperature and water salinity data by means of analysis. Printouts contain the respective number of the observation station and its coordinates. A block diagram for this program is presented. G.G.

N65-24247# International Geophysical Year World Data Center A, Washington, D. C.

CATALOGUE OF DATA IN WORLD DATA CENTER A: GRAVITY, TSUNAMIS, SEISMOLOGY, LONGITUDE AND LATITUDE, 1 JULY 1957–30 JUNE 1964. METEOROLOGY, 1 JANUARY–31 DECEMBER 1964

Washington, NAS, Jan. 1965 47 p

Presented are the world data received on gravity, tsunamis, seismology, longitude and latitude, as well as from meteorological observations. This collection of data represents numerous and widespread IGY observational programs. G.G.

N65-24255# Emmanuel Coll., Boston, Mass. Research Language Center

EARTH TIDES RESEARCH: GRAVIMETRY

N. N. Pariiskii et al Bedford, Mass., AFCRL, Aug. 1964 187 p refs Transl. into ENGLISH of the book "Izuchenie Zemnykh Prilivov: Gravimetriia" Rezul'taty Issled. po Programme Mezhdunarodnogo Geofiz. Goda, Izd. Akad. Nauk SSSR, no. 3, 1963 3, 1963

(Contract AF 19(628)-3869)

(E-T-RC-64-1; TT-65-61678; AD-611027)

This article gives a brief account of a report on earth tides, and it includes study of the tidal variations of gravity in Central Asia: Alma-Ata, Lanjow, and Tashkent. The mean value of δ for these three locations is $\delta = 1.138 \pm 0.002$, (much less than in Europe), according to the waves M_2, S_2, O_1, which are far from the resonance with a diurnal nutation. The correlation of results with respect to individual points as well as the results obtained in Tashkent with two instruments (deviations from the mean for the principal waves $<0.4\%$) shows good agreement. According to the Molodenski theory on the influence of the liquid condition of the core on the diurnal tides, a systematic difference between the values of δ for the waves O_1 and K_1 was found to be: $\delta(K_1) - \delta(O_1) = -0.026 \pm 0.005$. A considerable phase lag in the tidal variations of gravity from the equilibrium tide was discovered, but the instrumental lag in the GS-11 gravimeters has not yet been determined accurately. Author

N65-24259# Coast Guard, Washington, D. C. Coast Guard Oceanographic Unit

OCEANOGRAPHIC MANUSCRIPT: OCEANOGRAPHIC COMPUTER PROGRAMS FOR THE PROGRAMMED DATA PROCESSOR-5

Robert M. O'Hagan 15 Oct. 1964 47 p refs

A program written for a shipboard computer formats oceanographic data, computes sigma-t and the anomaly of specific volume from observed data of Nansen casts, and then proceeds to perform a Lagrangian interpolation for scaled values of temperature and salinity and computes sigma-t and the anomaly of specific volume for these scaled values. It

finally does a depth integration of the anomaly of specific volume from the scaled values of the recomputed anomaly of specific volume. Author

N65-24282# Atomic Weapons Research Establishment, Aldermaston (England).
THE EVALUATION OF CASCADE IMPACTORS DURING OPERATION ROLLER COASTER
D. M. C. Thomas Feb. 1965 18 p
(AWRE-O-7/65) HMSO: 2s 6d

Calibration parameters for the Casella and Andersen impactors were agreed upon; parameters most suited for evaluating the data are the characteristic diameters; agreed values of these for both instruments and of the MMD's for the Casella are given. Neither instrument will necessarily give a correct measure of the airborne concentration of the larger particles (greater than about 50μ) because of orifice effects; in addition there are losses at the first jet plates of the Andersen instrument. In a comparison of the Casella and Andersen data and the estimation of a complete size distribution of the airborne material, other information, such as that obtained with the cylindrical collectors, must be taken into account. Author

N65-24287# National Oceanographic Data Center, Washington, D. C.
INTERNATIONAL COOPERATIVE INVESTIGATIONS OF THE TROPICAL ATLANTIC: EQUALANT II Data Report
Albert M. Bargeski and John R. Frank, comp. 1964 758 p refs
Available from Naval Oceanog. Office: $5.00

Presented are the data from the multiship synoptic observational program on measurements of selected physical, chemical, biological, and meteorological properties in the tropical Atlantic Ocean. All observations were carried out during August–September 1963 by 11 vessels from various nations. The observations and samples common to most vessels at designated intervals were hydrographic casts; bathythermographic, meteorological, carbon 14, microbiomass, and zooplankton research; and night light collections. Special current studies and bottom trawling were undertaken by three ships. G.G.

N65-24306*# Southwest Center for Advanced Studies, Dallas, Tex.
THE MAINTENANCE OF THE NIGHTTIME F-LAYER
W. B. Hanson and T. N. L. Patterson May 1964 42 p refs Submitted for Publication
(Grant NsG-269-62)
(NASA-CR-62868) CFSTI: HC $2.00/MF $0.50

It is possible in principle that the nighttime F-layer is maintained either by H^+ ions in the protonosphere providing a source of O^+ ions through charge exchange, or by an upward drift of ionization which raises the layer to an altitude where recombination is slow. The steady-state solution of the H^+ and O^+ ion distributions and fluxes when the H^+ ions act as a source for the F-layer is presented. It is shown that, on the average, the number of H^+ ions that would be consumed by this process cannot be supplied by upward diffusion in the daytime. The alternative hypothesis for maintaining the nighttime F-layer by an upward drift of ionization is examined. The analysis is applied to a particular nighttime ionosonde record shown consistent with a vertical drift velocity of at least 30 m/sec. A method for deducing the drift velocity from h_mF2 and other ionospheric parameters is presented. Author

N65-24312# International Geophysical Year World Data Center C2, Kyoto (Japan).
CATALOGUE OF DATA IN THE WORLD DATA CENTRE C2 FOR GEOMAGNETISM
Kyoto Univ., Feb. 1965 70 p refs

N65-24363# Norwegian Defence Research Establishment, Kjeller.
EXPERIMENTAL STUDIES OF THE ARCTIC D-REGION Summary Report, 1 May 1963–30 Sep. 1964
B. Landmark 10 Dec. 1964 21 p refs
(Contract AF 61(052)-599)
(E-49; AFCRL-65-164; AD-613267)

High latitude particles and the different effects of these on the ionosphere are studied. A rocket range was established at Andoya in Northern Norway. A propagation technique was used successfully in electron density and collision frequency observations by means of rockets. Integrated rocket payloads carrying many related experiments in the same payload have been launched, and extensive ground-based observations undertaken. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N65-23388 Royal Observatory, Edinburgh (Scotland).
PRIMARY INSTRUMENTATION FOR THE SPECTRAL REGION BETWEEN 900 A AND THE VISIBLE
H. E. Butler and G. C. Sudbury *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 101–118 refs (See N65-23383 13-30)

Evaluation of scanning techniques and integrating image methods led to the recommendation to install devices of both systems in the observatory satellite. Also discussed are detector problems common to all optical systems; alternative optical systems for similar purposes; some other possible observations; calibration in wavelength and intensity; electronic processing; and command links. It was pointed out that the possibility of using photography in the satellite should be examined further. G.G.

N65-23389 Royal Observatory, Edinburgh (Scotland).
ASTROPHYSICAL POTENTIALITIES OF THE ULTRAVIOLET SCANNING MONOCHROMATOR
G. C. Sudbury *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 119–126 (See N65-23383 13-30)

An assumed Cassegrain telescope, with a primary diameter of 60 cm feeding a monochromator having 10 detectors arranged along the spectrum, was investigated for possible application in X-ray astronomy. Considered were (1) spectrometry at high resolution with an integration time of 5 seconds per picture point; (2) low resolution spectroscopy with a bandwidth of 10 Å and allowing 50 seconds per picture point; and (3) photometry with a bandwidth of 100 Å and an integration time of 500 seconds per picture point. Each case recorded a total

photon count of 10^4 per observed point. It was found that each case differed by five stellar magnitudes from its neighbors. The energy limits for all three cases were determined at wavelengths of 2700, 1800, and 1100 Å by the use of conversion factors, and were then applied to the stars listed in Biermann's Tables. All results are presented in tabular form. G.G.

N65-23391 University Coll., London (England).
X-RAY INSTRUMENTATION
R. L. F. Boyd *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 135–142 refs (See N65-23383 13-30)

The problem of studying stellar X-radiation reaching the vicinity of the earth centers on efforts to obtain high collection and detection efficiency to observe the very small fluxes. Background noise, cosmic rays, or thermal agitation must be minimized. Only grazing incidence systems show any promise for X-ray focusing of telescopes to provide an adequate signal. Suitable detectors can be (1) small tubular photomultipliers that can be grouped together for image dissection in a finite imaging system; or (2) proportional counters that offer higher photon efficiency, wavelength discrimination by pulse height analysis for wavelengths below 20 to 30 Å, and in addition guard against cosmic rays by pulse shape discrimination. The first system has little efficiency at shorter wavelengths, and the second has the disadvantage of great bulk. It is concluded that X-ray instrumentation in satellites is technically feasible. G.G.

N65-23397 United Kingdom Atomic Energy Authority, Culham (England).
INSTRUMENTATION FOR POLARIZATION MEASUREMENTS
R. Wilson *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 190–195 refs (See N65-23383 13-30)

A brief survey of existing polarization measurement techniques and devices is given and some possible developments are outlined. The use of doubly refracting crystals in the far ultraviolet region of 2000 to 3000 Å together with reflecting or fluorite optics should enable measurements down to 2000 Å. Plastic films are inferior to quartz crystals and should only be considered if large apertures are essential. Only LiF is suitable for polarization work in the extreme ultraviolet region of 1200 to 2000 Å. The LiF plate analyzers can be used for transmission as well as reflection polarizers by stacking of several plates. Insufficient data on the reflecting properties of materials at wavelengths below 1000 Å explain the absence of soft X-ray measurement devices. Polarizers in the infrared 2μ to 200μ consist of dielectric reflection polarizers, and wire grid polarizers. G.G.

N65-23400 National Physical Lab., Teddington (England).
DESIGN OF A POSSIBLE ULTRAVIOLET INTERFEROMETER FOR USE IN A SATELLITE OBSERVATORY
A. H. Cook *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 205–218 (See N65-23383 13-30)

The feasibility of using interferometric methods of spectroscopy for astrophysical satellite observations in the ultraviolet regions of the spectrum is discussed. The evaluation considered: (1) the general advantages of interferometric methods; (2) the problems to which an interferometer might be applied in the range 1000 to 3000 Å; and (3) the technical problems of an interferometer for 1000 to 2000 Å. Evaluation of the Michelson and the Fabry–Perot interferometers possessing rotational symmetry found the Michelson interferometer more suitable because it gives a greater discrimination. Possible ways of constructing this interferometer for use in a satellite are discussed with consideration given to a beam divider plate, mirror supports and movements, detectors, telemetry, predispersing system, and stabilization. It was concluded that satellite observations must first be available in order to define the field of work of an interferometer. G.G.

N65-23528 National Bureau of Standards, Washington, D. C.
A NEW HIGH ACCURACY SPECTRORADIOMETER
H. J. Kostkowski, D. E. Erminy, and A. T. Hattenburg *In its* Develop. of a Stable Ultraviolet Source and Tech. for Accurate Radiometry [1964] 8 p (See N65-23526 13-11)

A spectroradiometer for the calibration of spectral radiance standards, which achieves about a five-fold improvement in accuracy in the 8500 to 2500 Å region and extends the calibration range down to 2000 Å, is reported. The instrument is capable of an estimated accuracy of 0.3% at 6500 Å and 1.5% at 2100 Å. The spectroradiometer consists of a double monochromator with a photomultiplier detector and associated electronics, a stable high temperature blackbody, and a set of auxiliary sources used to determine the blackbody's temperature. The auxiliary sources include another blackbody maintained at the freezing temperature of gold, a vacuum tungsten strip lamp, and a multiple beam splitter device. All sources are mounted on a motor-driven lathe, allowing rapid and precise positioning of each image on the monochromator slit. When the temperature of the high temperature blackbody is known, its absolute spectral radiance at any wavelength is determined by Planck's radiation law. The spectral radiance of a source to be calibrated is then determined by direct comparison with the blackbody at each desired wavelength. E.E.B.

N65-23537# Los Alamos Scientific Lab., N. Mex.
MODEL 200 AC/DC AIR SAMPLER
Morris J. Engelke 7 Apr. 1965 22 p ref
(Contract W-7405-ENG-36)
(LA-3228-MS) CFSTI: $2.00

The Model 200 ac/dc air sampler is a completely portable, compact instrument for the qualitative detection of radioactive gases in the atmosphere. It is used primarily for the detection of tritium in the air in concentrations greater than $50\mu Ci/m^3$. The operation, maintenance, and performance in the field of the air sampler are described. Author

N65-23559# Academy of Sciences (USSR), Moscow. Astronomical Council
OPTICAL OBSERVATION STATIONS OF ARTIFICIAL EARTH SATELLITES, BULLETIN NO. 37 [STANTSII OPTICHESKOGO NABLYUDENIYA ISKUSSTVENNYKH SPUTNIKOV ZEMLI, BYULLETEN' NO. 37]
Jun. 1963 39 p refs In RUSSIAN

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N65-23560 Academy of Sciences (USSR), Moscow. Astronomical Council

A DEVICE FOR AUTOMATIC CONTROL FOR THE CAMERA WITH A MOVING FILM KPP [BLOK AVTOMATISCHESKOGO UPRAVLENIYA S'EMKOY NA KAMERE S PODVIZHNOY PLENKOY (KPP)]

Yu. P. Tsvetov *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 37 Jun. 1963 p 2–15 In RUSSIAN; ENGLISH summary (See N65-23559 13-14)

Construction and function of a device for block automatic control of the KPP camera are given. With this device, automatic photography is possible, higher accuracy can be obtained in time registration, and several cameras can work simultaneously. Author

N65-23561 Academy of Sciences (USSR), Moscow. Astronomical Council

A SPECIAL ADDITIONAL DEVICE WITH TRANSISTORS [IMPUL'SNAYA PRISTAVKA NA TRANZISTORAKH]

V. I. Sokhan' *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 37 Jun. 1963 p 15–16 In RUSSIAN; ENGLISH summary (See N65-23559 13-14)

A special additional device with transistors for printing precise time signals on the tape of a chronograph is described. It differs from those existing earlier by its high sensitivity, a negligible reaction to radio noise, and a very quick action. The latter has been achieved by means of a semiconductor relay installed at the exit. Author

N65-23562 Academy of Sciences (USSR), Moscow. Astronomical Council

A SPECIAL ADDITIONAL DEVICE TO THE CHRONOGRAPH TO IMPROVE ITS SENSITIVITY [PRISTAVKA K KHRONOGRAFU DLYA POVYSHENIYA EGO CHUVSTVITEL'NOSTI]

L. M. Zatsiorsky *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 37 Jun. 1963 p 16–19 refs In RUSSIAN; ENGLISH summary (See N65-23559 13-14)

An additional device on semiconductors to a printing chronograph for time signal registration from a quartz clock and back signals from the shutter of a standard camera is described. The delays are decreased up to $0^s.001$. Author

N65-23563 Academy of Sciences (USSR), Moscow. Astronomical Council

UTILISATION OF AN OSCILLOGRAPH FOR PHOTOMETRIC OBSERVATIONS [ISPOL'ZOVANIE VOS'MISHLEYFOVOGO OSTSILLOGRAFA V FOTOMETRICHESKIKH NABLYUDENIYAKH]

E. B. Gusev *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 37 Jun. 1963 p 20–22 refs In RUSSIAN; ENGLISH summary (See N65-23559 13-14)

A photometer with an artificial star for satellite tracking mounted on a TZK tube is described. The brightness variations of the satellite are registered on the film with the aid of an oscillograph MPO-2. The timing is done with a contact chronometer. For calibration of the light curves, stars are used. Author

N65-23564 Academy of Sciences (USSR), Moscow. Astronomical Council

A DEVICE FOR ESTIMATION OF THE PERSONAL ERROR OF THE OBSERVER IN REFERENCE TO TIME REGISTRATION [USTANOVKA DLYA ISSLEDOVANIYA LICHNOY OSHIBKI NABLYUDATELYA PRI REGISTRATSII VREMENI]

V. A. A. Vorotnikov *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 37 Jun. 1963 p 22–24 In RUSSIAN (See N65-23559 13-14)

The electrical circuitry of a device for estimating the human observer error in reference to time registration is described, and calibrational and operational procedures are given. M.P.G.

N65-23565 Academy of Sciences (USSR), Moscow. Astronomical Council

ERRORS IN POSITION DETERMINATION FOR COMBINED VISUAL-PHOTOGRAPHIC TRACKING OF SATELLITES [OSHIBKA POLOZHENIYA PRI VIZUAL'NO-FOTOGRAFICHESKOM SPOSOBE NABLYUDENIYA ISZ]

V. A. Merkushev *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 37 Jun. 1963 p 24–26 refs in RUSSIAN; ENGLISH summary (See N65-23559 13-14)

Possible errors in position determinations are described: the error in memorizing the position at the moment of time registration and the error of the imprint of a reper-star. An estimate of both these components is given, and it is proposed that micrometrical devices be used in order to decrease the imprint error caused by unexactness in pointing the telescope. Author

N65-23566 Academy of Sciences (USSR), Moscow. Astronomical Council

RESULTS OF PHOTOGRAPHIC OBSERVATIONS OF THE ARTIFICIAL EARTH SATELLITES [REZUL'TATY FOTOGRAFICHESKIKH NABLYUDENIY ISZ]

In its Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 37 Jun. 1963 p 27–33 In RUSSIAN (See N65-23559 13-14)

Tables of orbital data for various satellites are presented. The data were obtained from reduction of photographic observations made at Zvenigorod, Tartu Station, and Kharkov State University. The satellites observed were 1960 epsilon$_3$, 1961 alpha$_1$, 1961 alpha epsilon$_1$, 1962 iota$_2$, 1962 alpha omega$_2$, 1962 beta alpha$_1$, 1960 iota$_1$, 1962 beta theta$_2$, and 1963 17 B (Kosmos 17). M.P.G.

N65-23582 Academy of Sciences (USSR), Moscow. Astronomical Council

A VIEW-FINDER FOR SATELLITES ON THE BASE OF A TELESCOPE AT-I [ISKATEL' ISZ NA OSNOVE TRUBKI AT-I]

L. A. Panaiotov *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964 p 17–18 In RUSSIAN; ENGLISH summary (See N65-23577 13-07)

The telescope AT-I is reconstructed in such a way that the mirror fastened near the objective rotates to a certain limit around the optical axis. If the telescope is situated along the apparent orbit of the satellite it becomes possible by shaking the mirror to observe areas significantly larger than the field of sight of the telescope. Author

N65-23626 Academy of Sciences (USSR), Moscow. Astronomical Council

AN AZIMUTHAL MOUNTING OF A TRACKING CAMERA [AZIMUTAL'NAYA USTANOVKA FOTOKAMER DLYA NABLYUDENIYA ISZ]

A. A. Logvinenko *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 3–6 ref In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

An azimuthal mounting of a camera most appropriate for tracking of satellites is described. Instead of clamping screws, special brakes increasing the stability and efficiency of the camera are used. Several additional improvements for photographic tracking are suggested. Author

N65-23627 Academy of Sciences (USSR), Moscow. Astronomical Council

A SEMIAUTOMATIC FILM WINDING DEVICE FOR THE NAFA 3c/25 CAMERA [POLUAVTOMATICHESKAYA PEREMOTKA PLENKI V KAMERE NAFA-3c/25]

A. A. Logvinenko *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 6–8 ref In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

The kinematic and electric scheme of a semiautomatic film winding device in the NAFA 3c/25 camera is described. Author

N65-23628 Academy of Sciences (USSR), Moscow. Astronomical Council

RECONSTRUCTION OF SHUTTERS OF THE CAMERAS NAFA 3c/50 AND NAFA 3c/25 AT THE KRASNODAR TRACKING STATION [PEREDELKA ZATVOROV KAMER NAFA-3c/50 I NAFA-3c/25 NA KRASNODARSKOY STANTSII NABLYUDENIYA ISZ]

V. N. Ivanov and I. D. Bregeda *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 9–11 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

A reconstruction of shutters of the cameras NAFA 3c/50 and NAFA 3c/25 is described and results of their operation are given. Author

N65-23629 Academy of Sciences (USSR), Moscow. Astronomical Council

AUTOMATIC OPERATION OF THE SHUTTER OF THE PHOTOGRAPHIC TRACKING CAMERA NAFA-3c/25 [AVTOMATICHESKOYE UPRAVLENIE RABOTOY ZATVORA FOTOKAMERY NAFA-3c/25]

K. Lapushka *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 11–16 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

Construction of the exposure time program device for synchronous observations of satellites is described. The scheme of the device and the ways of operation are given. Author

N65-23630 Academy of Sciences (USSR), Moscow. Astronomical Council

OPERATION OF THE SHUTTER FOR THE NAFA 3c/25 CAMERA AND ACCURACY OF TIMING AT THE KHARKOV STATION [ISSLEDOVANIE RABOTY ZATVORA KAMERY NAFA-3c/25 I TOCHNOST' OPREDELENIYA VREMENI NABLYUDENIYA ISZ NA KHAR'KOVSKOY STANTSII]

P. P. Pavlenko *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 16–17 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

Investigations of the operation of the shutter for the camera NAFA 3c/25 supplied with an oscillograph ENO-1 and photomultiplier FEU-25 are described. Principal timing errors for devices used are mentioned. The mean square error of timing in the system of standard time is $\pm 0^{s}.004$. Author

N65-23633 Academy of Sciences (USSR), Moscow. Astronomical Council

MARKING OF THE IMPRINTS OF A CHRONOGRAPH [MARKIROVKA OTPECHATKOV KHRONOGRAFA]

A. A. Logvinenko, I. I. Terebushko, and V. V. Tret'yakov *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 20–22 ref In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

A method for the connection of tubes TZK and AT-1 to a chronograph is described, showing by pulse duration which imprint belongs to the corresponding device. This eliminates possible errors in chronograph imprint deciphering, and allows simultaneous observations with several tubes and one chronograph without special registration. Author

N65-23637 Academy of Sciences (USSR), Moscow. Astronomical Council

THE USE OF QUARTZ CLOCK FREQUENCIES FOR DRIVING THE SYNCHRONOUS MOTOR OF A PRINTING CHRONOGRAPH [ISPOL'ZOVANIE CHASTOTY KVARTSEVYKH CHASOV DLYA PITANIYA SINKHRONNOGO MOTORA PECHATAYUSHCHEGO KHRONOGRAFA]

K. Lapushka *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 28–30 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

A practical scheme is given for connecting a printing chronograph generator with a quartz clock in order to diminish the rate of the chronograph. Author

N65-23638 Academy of Sciences (USSR), Moscow. Astronomical Council

PROTECTION OF THE OPTICS OF TRACKING TELESCOPES FROM PERSPIRATION AND FROSTING [PREDOKHRANENIE OPTICHESKIKH STEKOL TRUBOK DLYA NABLYUDENIYA ISKUSSTVENNYKH SPUTNIKOV ZEMLI OT ZAPOTEUANIYA I OBINDEVENIYA]

V. V. Shmeling *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40, 1964 p 30–32 In RUSSIAN; ENGLISH summary (See N65-23625 13-07)

A simple device is described for protecting the optical parts of TZK telescopes from perspiration and frosting by means of creating an airblow with a rubber hand balloon. Author

N65-23741*# Geophysics Corp. of America, Bedford, Mass. Technology Div.

SOLIDS MASS SPECTROMETER Final Report

R. F. K. Herzog, H. J. Liebl, W. P. Poschenrieder, and A. E. Barrington Feb. 1965 67 p refs

(Contract NASw-839)

(NASA-CR-62717; GCA-TR-67-7-N) CFSTI: HC $3.00/MF $0.75

Constructional improvements of a solids mass spectrometer and perfections in experimental technique are reported. The improvements and perfections resulted in a new tool with exceptionally high sensitivity for the nondestructive analysis of solids. The methods employed for the successive reduction and final elimination of the instrumental background of the sputtering ion source and of the solids mass spectrometer are discussed. They include many refinements and innovations of vacuum technique; of particular importance was the utiliza-

tion of spectroscopically pure structural materials in the ion source. The performance of the improved instrument is described, and it was possible to determine the sensitivity for the detection of trace elements with a series of doped semiconductor samples of accurately known concentrations. The design of a miniaturized solids mass spectrometer with a sputter-ion source for analysis of the lunar surface is presented. The proposed specifications of the instrument are compatible with the payload requirements for a soft-landing lunar probe. Author

N65-23743# National Bureau of Standards, Washington, D. C. Data Processing Systems Div.
STUDY, MTMS, STEREO INPUT
Martin C. Stark and Leonard Cahn Jan. 1964 18 p
(Order Na61339-1-59)
(NAVTRADEVCEN-1-59-1; AD-430702)

Photographs and drawings of a lathe-type scanner in which the subject copy is mounted on a rotating drum are presented. It incorporates two separate optical systems, one for sensing the sync bars and the other for sensing the reflection density of the elementary areas on the subject photograph. An electronics system converts the analog signal from the picture photomultiplier to a digital recording on the magnetic tape. The relationship between the picture format, magnetic tape format, and computer magnetic core format is shown by layout, and several replicas of computer printouts illustrate the ability of computer programs to process, rearrange, and reduce the scanned data inputs. G.G.

N65-23744# Naval Air Development Center, Johnsville, Pa. Aeronautical Photographic Experimental Lab.
APPLIED RESEARCH AND INVESTIGATION OF COMPONENTS, EQUIPMENT AND SYSTEMS OF 70mm AERIAL PHOTOGRAPHY TO DETERMINE PERFORMANCE CRITERIA FOR RECONNAISSANCE PURPOSES Interim Report
10 Jan. 1964 8 p
(NADC-AP-6403; AD-430963)

This report describes the resolution performance of prototype lenses which provide high resolution at relatively wide apertures. Four of the lenses cover the 70-mm format and one covers the 4 1/2 in. × 4 1/2 in. format. Author

N65-23745# General Precision, Inc., Wayne, N. J. Systems Div.
EFFECT OF ROTATION ON VELOCITY ERROR IN A PULSE INTEGRATING GYRO ACCELEROMETER (PIGA), MOBILE MID-RANGE BALLISTIC MISSILE GUIDANCE AND CONTROL SUBSYSTEM
30 Jun. 1964 40 p *Its* Rept.-823.077-015
(Contract AF 04(694)-558)
(BSD-TR-64-347; AD-456620)

A pulse integrating gyro accelerometer is a velocity meter in that its output has a dimension of velocity. Velocity error is caused by a limited frequency response and also by the angular velocity of its housing. As a result, the output of a velocity meter during rotation contains unwanted components which are functions of angular velocity. If rotation occurs only over a finite time interval, the velocity error caused by rotation becomes equal to zero outside that interval. Velocity error during rotation, caused by an angular velocity of 1 radian per second about an axis, will not exceed about 0.37 feet per second provided that compensation is used. An error of 0.37 feet per second in thrust velocity is tolerable if it exists only over a short time interval. Author

N65-23770# Federal Aviation Agency, Atlantic City, N. J. Evaluation Div.
EVALUATION OF BAROMETRIC ALTIMETRY AT LOW ALTITUDE Final Report
Donald J. Bourque Jan. 1965 31 p
(RD-65-7)

An evaluation was conducted to determine the mean and standard deviation of errors in determining a height of 100 feet above the runway by using the barometric altimetry systems aboard the Boeing 720 and Convair 880 on instrument landing system (ILS) approaches. The ILS approaches were extended as low level runs above the runway to determine the barometric altimetry systems errors during level flight. It was concluded that a height of 100 feet could have been determined during descent to an average standard deviation of 5.2 feet and 7.7 feet for the Boeing 720 and the Convair 880, respectively, and during level flight to an average standard deviation of 6.5 feet and 8.4 feet for the Boeing 720 and the Convair 880, respectively, provided the barometric altimetry systems were corrected by the amount of the mean error for each case. Author

N65-23788* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIGNAL CONDITIONING CIRCUIT FOR AN OSCILLOSCOPE DISPLAY OF BENDING
Charles P. Elms *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 62-65 refs (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

The problem of displaying the bending action of a space vehicle or a structural beam is treated by employing a switching circuit that samples the outputs of accelerometers fixed to the frame of a vehicle and displays them on the screen of an oscilloscope. The sampled data are displayed as a vertical column of points representing the sensors. Vertical spacing is proportionate to the spacing of the sensors on the vehicle. The bending motion is represented by horizontal motion of the points proportionate to the bending motion sensed. A formula for calculating the mininum required sampling rate for an input of chosen maximum frequency is derived, based on the amount of maximum tolerable horizontal display error. The circuit can be used with any single beam oscilloscope having external intensity modulation capability. It is of simple design, and is useful in applications other than bending where more than one variable is to be displayed on one instrument. The circuit was built and used to display the bending motions of the Saturn V vehicle simulated by an electronic elastic beam model. Author

N65-23790* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PROPELLANT SLOSH MEASURING SYSTEM FOR SPACE VEHICLES
B. G. Bynum and John F. Hamlet *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 72-77 (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

The theory and configuration of a capacitance system are described that may be used to measure the first mode of propellant slosh. Two pairs of parallel flat-plate capacitance probes extending the length of the propellant tank are connected into two bridge circuits. Difference in liquid height on diametrically opposed probes causes a difference in capacitance between the two probes. This difference unbalances the bridge circuit and causes a voltage output from the electronics package proportional to the height of slosh. The electronic theory of the system is presented with an explanation of the circuit design and operation. The design of the probes is described, and supporting theory is presented. Circuit diagrams and

illustrations of the electronics network, probe construction, and vehicle installation are included. Tests proved that the system measured slosh accurately within 1.5 cm. Author

N65-23874# European Atomic Energy Community, Brussels (Belgium).
TEST EQUIPMENT FOR ACCURATE DETERMINATION OF TIME RELATIONS AND ITS USE FOR THE MEASUREMENT OF THE TIMING ACCURACY AND THE CALIBRATION OF FAST PHOTOMULTIPLIERS
H. Meyer and H. Vereist Feb. 1965 35 p refs
(EUR-2247.e) Available from Belg. Am. Bank and Trust Co., N.Y., Account No. 22.186 50 Belg. Fr.

Silicon p-n junctions are used as pulsed light sources for simulation of detected radiation. Detection of time information out of photomultiplier pulses is studied; a fast precise discriminator and two << zero crossing >> circuits different in their detailed function, were realized. When measured with electronic exponentially shaped pulses, both zero crossing circuits gave a residual time uncertainity, smaller ±0.1 nsec for pulse amplitudes between 0.5 and 5 V and pulse rise times up to 20 nsec. For photomultiplier pulses from light pulses of constant amplitude, a timing accuracy (σ), smaller 0.1 nsec with the discriminator and of 0.2 with the two zero crossing circuits were reached. A fast coincidence unit and a time/height converter were used for time measurement. An example of their application is given. Author

N65-23877# National Physical Lab., New Delhi (India). Radio Propagation Unit
ELECTROMETER AMPLIFIER FOR MEASURING SMALL CURRENTS Scientific Report No. 16
H. C. Gulati 15 Oct. 1964 16 p refs
(RPU-S-16; SR&RA-4)

This report describes the design of a simple circuit for measuring currents of the order of 10^{-11} to 10^{-10} A in conjunction with an ionospheric probe experiment for rocket sounding of the lower ionosphere. A practical version of the circuit was constructed and the test performance given. Author

N65-23887# Maryland Univ., College Park. Dept. of Physics and Astronomy
AN *IN SITU* PROBE SYSTEM FOR THE MEASUREMENT OF IONOSPHERIC PARAMETERS
Richard T. Bettinger (Ph.D. Thesis) Jan. 1965 253 p refs
(Contracts AF 19(604)-5575; AF 19(604)-3861; AF 19(628)-2792)
(AFCRL-64-676; AD-458657)

A complete in situ probe system consisting of (1) thermal equalization probes to measure independently vehicle potential, (2) a pulse probe to measure electron concentration and energy distribution and (3) a Langmuir probe to supply information on positive ion and electron temperatures has been designed and tested. This system, along with the requisite telemetry elements was packaged into an ejectable rocket payload. Preliminary flight test results presented indicate generally satisfactory operation of the various probes and point to a number of design modifications. Vehicle potentials were measured on several flights. Its reaction to dc sweeps, vehicle velocity and solar radiation is demonstrated and discussed. It is concluded that a high energy tail in the normal daytime electron energy distribution exists. Author

N65-23928*# AVCO Corp., Tulsa, Okla.
PULSE COUNTING DETECTORS FOR LOW ENERGY PARTICLES AND HIGH ENERGY PHOTONS Bi-monthly Report, 10 Apr.–10 Jun. 1964
J. E. Russell 19 Jun. 1964 16 p
(Contract NASw-783)
(NASA-CR-62743; BMR-1) CFSTI: HC $1.00/MF $0.50

The extreme ultraviolet source was redesigned to provide a much more intense beam of protons. Also, the electron source and the ion source were made more compatible in regard to control electronics so that one set of electronics for these sources may be rapidly switched from one to the other. Further, two of the multipliers were retested for determination of deterioration due to long exposure to the atmosphere; initial results were good. Evaluation of several circuit approaches led to the selection of integrated circuit modules for the low frequency portion of the circuits. The multiplier amplifier was ruggedized with a frequency response of 60 Mc, and a gain of 700; it consumes only 60 mW of power. E.E.B.

N65-23940 Aeronautical Research Council (Gt. Brit.)
FLIGHT AND TUNNEL TESTS TO DEVELOP A THERMAL DETECTOR FOR DETERMINING THE BOUNDARY LAYER STATE
Ann Cronin and O. P. Nicholas London, HMSO, 1965 30 p refs Supersedes RAE-TN-AERO-2953, ARC-26010
(ARC-CP-781; RAE-TN-AERO-2953; ARC-26010) HMSO: 6s

Suitability was investigated of a thermal detector for determining the boundary-layer state on an aircraft, based on the principle of more rapid heat transfer across a turbulent, compared with a laminar, boundary layer. Following successful laboratory and wind tunnel tests, a few subsonic flight tests with the detectors mounted in a flat plate showed that they could be used satisfactorily to determine boundary layer state. This detector can be used to a working temperature of 80° C and hence could be used to give adequate signal changes up to Mach 1.5 above the tropopause. Further laboratory tests on another detector of similar design using higher temperature components suggest that it could be used up to Mach 1.9 above the tropopause. Author

N65-23984* Atomic Energy Commission, Washington, D. C. Div. of Biology and Medicine
ATOMIC ENERGY COMMISSION HIGH ALTITUDE SAMPLING SYSTEMS
Robert W. Beadle *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 37–48 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Studies in the research and development of stratospheric sampling systems for the collection of radioactive particulate and gaseous contaminants are made. Operational balloon sampling sites are maintained at Goodfellow Air Force Base, San Angelo, Texas, and Mildura, Australia. The sampler systems fall into two categories: balloonborne from 65 000- to 130 000-ft altitudes, rocketborne from 130 000- to 250 000-ft altitudes. The balloonborne samplers under development employ either filter paper, impactors, or electrostatic precipitators as the collection mechanism. The rocketborne samplers will employ either large area filtration, cryogenic freezeout, or cryogenic sorption as the collection mechanism. The operational requirements of altitude capability, sample size, and sampler system recovery, and the design parameters of weight, sampling rate, vehicle, and sampling mechanism are described. Author

N65-24018*# Hayes International Corp., Birmingham, Ala. Apollo Logistics Support Group

APOLLO LOGISTICS SUPPORT SYSTEMS MOLAB STUDIES. TV SUBSYSTEM STUDIES FOR A LUNAR MOBILE LABORATORY

J. C. Mc Bride Huntsville, Ala., NASA. Marshall Space Flight Center, 31 Mar. 1965 67 p refs

(Contract NAS8-5307)

(NASA-CR-61054) CFSTI: HC $3.00/MF $0.75

Three classifications of camera tubes are considered for a slow scan, shuttered operation in a lunar mobile laboratory (MOLAB). The earth control station for the remote driving of the MOLAB is described as to the display of the information necessary for successful operation. Three methods of display of stereo television are described, with the advantages and disadvantages of each listed. A possible method for including predicted position information on the television display is included. The uses of television during the manned phase, i.e., the aids to the scientific mission, also are investigated. Suggestions are made for providing a limited spectral analysis capability to the television. Feasibility of including a television monitor in the command and/or the lunar excursion module is considered as to the weight, volume, and power penalties. The weight and volume trends are described as the screen size varies; and two examples of space-qualified monitors are included. Author

N65-24035*# National Aeronautics and Space Administration, Washington, D. C.

SPECTROMETER FOR MEASUREMENT OF SOLAR EMISSION IN THE EXTREME ULTRAVIOLET [SPEKTROMETR DLYA IZMERENIYA IZLUCHENIYA SOLNTSA V DALEKOM ULTRAVIOLETE]

A. V. Bruns and V. K. Prokof'yev 1 Jun. 1962 12 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), v. II, 1961 p 23–29

(NASA-TT-F-8233) CFSTI: HC $1.00/MF $0.50

A two-channel diffraction spectrometer for measurement of the solar ultraviolet resonance line of ionized helium is described. The cathode of the photomultiplier receives emissions from the 1700 to 2000 Å region, using the spectrum of the zero order for calibration; scanning near the line λ 303.8 Å of a certain portion of the spectrum of the second order is possible. The instrument consists of the spectrometer itself with a reinforced tracking system, electrical control block for the tracking system, a measurement registering system and its electric block, and a feeding block. A block diagram of the spectrometer's kinematic scheme is shown. The measurement registering installation, to be used in a spaceship-satellite, is described in detail. Function of the registering system, in which very extreme ultraviolet signals are picked up in the form of pulses of current whose frequency is proportional to the photocathode illumination, is explained. A block diagram and schematic of the circuitry are included for the installation. J.M.D.

N65-24067# Bureau of Mines, Amarillo, Tex. Helium Research Center

A PORTABLE HELIUM ANALYZER

A. A. Sonnek, J. C. Meeks, Jr., C. L. Klingman, and C. A. Seitz 1965 19 p refs

(BM-RI-6600)

A simple, portable helium analyzer was developed primarily for field use. Its utility lies in making preliminary surveys before exact analyses are required. The analyzer is based upon chromatographic principles; that is, separation of gas mixtures resulting from variable retention times of the components with respect to a separation medium (column-packing material). It uses thermistors for sensing detectors, a dry battery as source of power, and a microammeter for indicating helium concentration. The absolute accuracy of the instrument depends upon the recency and care with which the instrument is calibrated with a standard gas. The unknown gas should be analyzed immediately after calibration, and another calibration should be made before another unknown sample is analyzed. The instrument is simple to operate, requiring approximately 15 minutes, after calibration, to determine the helium content of a natural gas sample. Although developed primarily for helium determination, the analyzer possibly can be used for other analyses that can be performed at ambient temperatures. Author

N65-24089# Rocketdyne, Canoga Park, Calif.

DEVELOPMENT OF A SYSTEM FOR THE IDENTIFICATION OF ROCKET EXHAUST PRODUCTS Final Report

W. F. Netusil, R. L. Proffit, and J. D. Enloe Edwards AFB, Calif. AF Rocket Propulsion Lab., Apr. 1965 83 p refs

(Contract AF 04(611)-7050)

(R-5878; AFRPL-TR-65-70; AD-461444)

A system for the on-line analysis of combustion processes is discussed, and the test results of such a system are presented. The system for high-pressure combustion analysis is composed of a laboratory-scale combustor and test stand, a gas-sampling system and a time-of-flight mass spectrometer (TOFMS). Also discussed is a flame sampling probe for atmospheric flame studies. A commercial Knudsen cell inlet system was supplied for use with the TOFMS in determining ionization potentials of gas species. Author

N65-24168 Joint Publications Research Service, Washington, D. C.

EFFECT OF THE ACCELERATIONS OF AN OBJECT ON THE ACCURACY OF THE READINGS OF THE GYROAZIMUTH

M. M. Bogdanovica *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 148–156 refs (See N65-24150 13-09) CFSTI: $6.00

Effect of accelerations of an object on a gyroazimuth equipped with horizontal and azimuthal corrections is considered. Investigation of the laws of motion of the gyroazimuth axis make possible these conclusions: In the presence of horizontal accelerations of the base, the error of the gyroazimuth has the minimum value in a case when the center of gravity is located at the axis of natural rotation of the gyroscope. If the center of gravity is biased along the vertical axis Oz_1, to reduce the deviation in the azimuth, it is necessary to keep the axis strictly on the plane of the horizon. Author

N65-24169 Joint Publications Research Service, Washington, D. C.

BASIC MUTUAL CONNECTIONS OF THE DESIGN AND AERODYNAMICS OF GYROMOTORS

A. G. Bessonov *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 157–170 refs (See N65-24150 13-09) CFSTI: $6.00

The mutual connections between the operating conditions of a gyromotor, the basic requirements for its design, and various methods of reducing aerodynamic resistance are considered. Classification tables are proposed that make it possible, in the development of a gyromotor, to determine the most feasible methods of reducing aerodynamic losses. Author

N65-24171 Joint Publications Research Service, Washington, D. C.
DRIFTS OF A DYNAMICALLY UNBALANCED GYROSCOPE INSTALLED ON AN OSCILLATING BASE
I. M. Bodnyatskiy and Ya. L. Lunts *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 177–183 refs (See N65-24150 13-09) CFSTI: $6.00

The motion of a gyroscope on a moving base, with a small dynamic imbalance of the rotor, and an essential dynamic imbafance of the gyro housing is studied. Formulas are obtained for calculating systematic drifts of the gyroscope axis. Author

N65-24172 Joint Publications Research Service, Washington, D. C.
ON THE SYSTEMATIC DRIFT OF A FREE GYROSCOPE
L. I. Kargu, I. M. Okon, and L. I. Roberman *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 184–188 refs (See N65-24150 13-09) CFSTI: $6.00

The behavior of a free gyroscope is considered in a case of the application of an instantaneous moment of a pulse of forces around the outer axis of its suspension. Author

N65-24173 Joint Publications Research Service, Washington, D. C.
ON THE PROBLEM OF PRESERVING A HORIZONTAL POSITION OF THE PLATFORM DURING BANKING
V. Yu. Torochkov *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 189–192 ref (See N65-24150 13-09) CFSTI: $6.00

A scheme for a gyroscopic instrument for obtaining a correcting horizontal platform during banking of an aircraft is considered. The equations of motion are given. Author

N65-24175 Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF FREQUENCY ACCELERATION PICKUPS WITH MECHANICALLY CONCENTRATED PARAMETERS
A. V. Ivanov *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 201–208 refs (See N65-24150 13-09) CFSTI: $6.00

The possibility of using self-oscillating oscillators with concentrated parameters for measuring slowly changing accelerations is studied. The method of equivalent linearization is used for deriving the basic relationships connecting the change in self-oscillation frequency with the change in external acceleration for direct- and indirect-acting pickups. Author

N65-24176 Joint Publications Research Service, Washington, D. C.
THE DYNAMOMETER SYSTEM OF N. G. TOKAR' FOR ALTERNATING CYCLICAL LOADS
I. I. Mokeyev *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 209–213 refs (See N65-24150 13-09) CFSTI: $6.00

A description is given of the method of checking the design of a ±50-ton dynamometer system intended for checking the readings of double-acting hydropulsating testing machines. The errors are evaluated. Author

N65-24177 Joint Publications Research Service, Washington, D. C.
PRELIMINARY CALCULATION OF THREE-COMPONENT VARIABLE-MAGNIFICATION SYSTEMS
A. P. Smitriyev *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 214–221 refs (See N65-24150 13-09) CFSTI: $6.00

Formulas are derived for calculating three-component variable-magnification systems for determining the regions of existence of symmetrical systems, including systems with a stabilized position of the pupils. Examples are given of systems suitable for practical application. Author

N65-24194# Martin Co., Orlando, Fla.
CHARGED PARTICLE GRAVITOMETER RESEARCH Final Report, 1 Jan.–31 Dec. 1964
Robert A. Cunningham and John J. Stalder Apr. 1965 113 p refs
(Contract AF 19(628)-3992)
(OR-6377; AFCRL-65-103; AD-614681)

Charged-particle measurement techniques were investigated regarding their capabilities for absolute and relative gravity measurements. Force-balance particle techniques, particle pendulum approaches, and free-particle methods were evaluated analytically and experimentally in relation to gravity measurement requirements. Free-particle bouncing and recapture methods were determined to be the most appropriate with experiments demonstrating general performance feasibility. Additional development is required to achieve suitable free-particle instrumentation techniques. Research could then be conducted to evaluate and minimize error sources. It is concluded that free-particle relative gravity measurement capabilities should be evaluated before absolute gravity techniques are developed. Author

N65-24276 United Kingdom Atomic Energy Authority, Harwell (England). Electronics Div.
AN INVESTIGATION INTO THE MODE OF WORKING OF THE ULTRASONIC MICROMETER USED IN THICKNESS MEASUREMENTS OF THIN WALL STAINLESS STEEL TUBING
E. E. Aldridge Jan. 1965 55 p refs
(AERE-M-1510)

The ultrasonic micrometer consists of an oscillator producing long pulses of carrier driving a transducer ultrasonically coupled to the steel, whose thickness is being measured, through the medium of a water column. When the carrier frequency is adjusted such that the electrical output signal of the transducer exhibits a null in the middle of the pulse, then the steel is very nearly in half wave dilatational resonance or multiples thereof, and hence a measure of its thickness can be obtained. Using simple dilatational theory, an analog was built in which the steel was represented by a high impedance delay line with a short circuit termination and the water by a low impedances being similar to the ratio of the characteristic acoustic impedances of steel and water and the function of the hybrid being similar to that of the water column. This analog is found to agree with the physical system, provided a loss is introduced into the steel. It is found theoretically that when the frequency of the carrier is close to a Lamb-wave cutoff frequency for the steel, energy incident on the steel–water interface is scattered and, provided the cross-sectional pressure distribution of the incident beam is suitable, this mechanism is sufficient to account for the necessary loss. Author

N65-24279 United Kingdom Atomic Energy Authority, Harwell (England). Electronics Div.

A FAST NEUTRON DOSE EQUIVALENT RATE MONITOR

J. W. Leake Jan. 1965 20 p refs

(AERE-R-4525) HMSO: 4s

A fast neutron dose equivalent ratemeter was developed to cover the neutron energy range from 3 to 25 MeV. The neutron dose equivalent is estimated by measuring the total light emission from a liquid organic scintillator, NE 213. Dose equivalent indication is given by means of a ratemeter whose output is directly proportional to the product of the amplitude of the light pulses and their frequency. The gamma ray discrimination properties can be adjusted so that a gamma ray exposure rate of 10 mR/hour from radium 226 gives a response which is less than that due to 0.25 mRem/hr of AmBe neutrons. The sensitivity of the instrument, using a 1-inch-diameter scintillator, is such that 1 mRem/hr of AmBe neutrons produces a count rate of about 3 pulse/sec (for a 1-MeV neutron bias). The sensitivity may be increased by about a factor of 5 by enlarging the scintillator size to 2 in. in diameter; but this reduces the neutron/gamma ray rejection ratio. In addition to a meter display calibrated in mRem/hour the indicator unit also provides a linear pulse output signal which may be fed into an external pulse height analyzer to give the proton recoil spectrum, from which the neutron energy spectrum can be subsequently calculated. Alternatively, the system may be used to measure the neutron flux density from monoenergetic neutron sources. Author

N65-24298*# Princeton Univ., N. J. Guggenheim Labs. for Aerospace Propulsion Sciences

JP24 TRANSIENT PRESSURE MEASURING METHODS RESEARCH Status Report, 1 Jan.–31 Mar. 1965

J. P. Thomas and J. P. Layton 30 Apr. 1965 4 p

(Contracts NASr-36; NAS8-11216)

(NASA-CR-62843) CFSTI: HC $1.00/MF $0.50

Transducer evaluation and improvement of laboratory equipment and techniques continued. The research was directed toward uncooled transducer assemblies, signal conditioning systems, and instrumentation, while the laboratory transducer coolant system was modified to receive a new high-pressure vessel. A special heat-transfer study was made using the flush diaphragm Dynisco PT134 transducers in rocket motor tests. Preliminary evaluation of several assemblies was started, and the effect of passage length, connecting volume, and geometry on the performance of transducers used with the Princeton Small Passage Technique was studied. Performance testing of the Sinusoidal Pressure Generator is under way after modification of the pressure chamber. Shock tube testing at various pressure-step levels was initiated, and development of a computer program to yield phase and amplitude ratio vs frequency was continued. Meetings were held with manufacturers, NASA technical personnel, and other users of transient pressure measuring instruments to discuss current transducer performance and further improvement, as well as future requirements for transient pressure transducers. Author

N65-24307*# RAND Corp., Santa Monica, Calif.

INSTRUMENTATION TO MEASURE MARS' ATMOSPHERIC COMPOSITION, USING A SOFT-LANDED PROBE

R. O. Woods and J. W. Ranftl Apr. 1965 26 p refs

(Contract NASr-21(09))

(NASA-CR-62870; RM-4451-NASA) CFSTI: HC $2.00/MF $0.50

The most suitable method for determining the composition of the Martian atmosphere, using a soft-landed probe, is sought. The methods considered include optical spectroscopy, mass spectrometry, gas chromatography, and other means of gas analysis. Of all the methods investigated, mass spectrometry appears best suited to Martian atmospheric analysis. Not only is the technique intrinsically well suited to the analysis of an unknown mixture of fixed gases, but the output can be telemetered with a minimum of processing. The construction and power requirements of mass spectrometers are readily compatible with spaceborne applications. It is estimated that such an instrument would weigh about 5 to 8 pounds and require 5 to 10 watts of power. Author

N65-24318# Atomic Weapons Research Establishment, Aldermaston (England).

PARTICLE SIZE ANALYSIS IN THE SUB-SIEVE RANGE WITH AN AWRE CENTRIFUGAL PHOTOSEDIMENTOMETER

M. W. G. Burt Aug. 1964 44 p refs

(AWRE-0-76/64)

A new instrument for the measurement of particle size in the subsieve range is described. It consists of a disc-shaped centrifuge in which the suspension is analyzed by measuring the optical density at a fixed point. Tests have given consistent and meaningful results on a variety of materials. Author

N65-24330# Cutler-Hammer, Inc., Deer Park, N. Y. Airborne Instruments Lab.

ILS FLIGHT CHECK SYSTEM Final Report

D. J. Creber Jan. 1965 94 p

(Contract FAA-ARDS-565)

(SRDS-RD-65-5)

System feasibility checks on the Guide Light System show that it has high resolution and a reasonably good range. On a bright sunny day, the Guide Light System operating range was found to be about 3 1/2 n.mi.; on a clear night, the range was about 5 1/2 n.mi. Ground tests showed that the course shift as a function of range was negligible. This system consists of a ground station and an airborne flight-check receiver. At the ground station, the light from a 1-kilowatt tungsten-filament source is split into two light bands (infrared and visible) and modulated by a rotating drum. The flight-check aircraft receiver demodulates the light beams and, by measuring the phase angle between the demodulated audio signals, determines the in-space angular location of the aircraft. Angular information is contained in a 0.6-degree-wide beam symmetrically spaced about the centerline. The receiver output is calibrated to give $\pm 150\ \mu a$ at the beam edge. The receiver permits simple and direct self-calibration using an output that is fully compatible with the existing cockpit displays and recording equipment in FAA calibration aircraft. Author

N65-24331# Union Carbide Nuclear Co., Oak Ridge, Tenn. Physical Measurements Dept.

A GRAVIMETRIC GAS FLOW STANDARD. PART I: DESIGN AND CONSTRUCTION

W. T. Collins and T. W. Selby 18 May 1965 66 p refs

(Contract W-7405-ENG-26)

(K-1632, Pt. 1)

A versatile standard for measurement of gas flow was designed and constructed. The design is based on use of a gravimetric technique in which the time required to collect a given mass of air in a weighing bottle is determined. Equal-arm balances of 2- and 50-kilogram capacity are used to weigh the mass of air collected. The balances have been modified to operate automatically using servo-operated chain weights, and are remotely controlled from a central control console. Cylindrical weighing bottles having fiberglass–epoxy filament wound walls are used to collect the air samples. The largest bottle weighs about 44 kilograms (386 liter volume) and the

smallest weighs about 1 kilogram (3 liter volume). Design criteria and construction features are discussed. Current estimates of the uncertainties indicate that the mass flow rate can be determined to ±0.1% over the range of 0.06 to 1650 grams of dry air per minute. Author

N65-24354*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPARISON OF TWO INSTRUMENTS FOR DETERMINING HARDNESS OF ELASTOMERS
J. T. Schell and C. D. Hooper 26 Mar. 1965 36 p
(NASA-TM-X-53226) CFSTI: HC $2.00/MF $0.50

To reach a higher degree of accuracy in control evaluations of rubber compounds, a comparison was made of two commercially available instruments for measuring hardness of elastomeric compounds. These instruments, the Shore durometer and ASTM (Tinius Olsen), were compared over a wide hardness range on 13 types of rubber formulations. Studies indicated that, although the ASTM instrument requires a more refined test specimen and is somewhat more difficult to operate, it is a more precise instrument and should be used where very close tolerances are involved or as a referee in case of doubt with other instruments. The Shore durometer provides a rapid means for measuring hardness of elastomers; the specimen size is not critical; and the Shore durometer accuracy is sufficient for control evaluations as well as for the majority of end items. With the graphs and tables in this report, it is possible to convert units of measure from one instrument to the other for a particular compound of interest; however, to prepare a single table (or graph) illustrating a typical correlation for all elastomers is not practical because of the variation in creep with different formulations. Author

N65-24387*# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF A VAPOR-PRESSURE-OPERATED HIGH-TEMPERATURE SENSOR DEVICE Final Report
J. R. Van Orsdel, G. E. Raines, and J. M. Allen 11 Mar. 1965 70 p refs
(Contract NAS3-5202)
(NASA-CR-54369) CFSTI: HC $3.00/MF $0.75

Vapor-pressure curves for several low melting point metals are presented as a basis for selection of a temperature sensor charging metal. Candidate sensor probe materials are discussed and chosen on the basis of melting point, high-temperature strength, and availability. Tests are described and the results reported on the compatibility of various probe and charging metal combinations. A special test for studying hydrogen diffusion through the probe at high hydrogen pressures and temperatures is described. A thermal analysis of the probe was made assuming both transient and steady-state conditions. Estimates of steady-state probe temperature and variations in response time are reported. However, the severity of the hydrogen–diffusion problem makes the probe in its present state of development unsuitable for the intended application. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N65-23532 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ZONE MELTING OF NIOBIUM BY THE ARC METHOD
A. I. Yevstyukhin, V. V. Nikishanov, and I. V. Milov *In its* Met. and Metallography of Pure Metals 23 Apr. 1963 p 14–26 refs (See N65-23530 13-17)

An apparatus for zone melting of high-melting metals by the electric-arc method was built, tested, and performed reliably. Tests were conducted in the purification of niobium by the zone method. An effect of purification from lead and carbon was detected at a zone speed of 0.5 mm/sec. Test results show that under certain melting conditions (v = 0.5 mm/sec and l = 20 mm), the purification limit is not attained even after 120 to 130 passes. The radioactive isotope method is effective for detecting purification effect. In combination with other methods, the radioactive isotope method facilitates and accelerates monitoring of the processes in zone melting. To purify niobium by arc zone melting, it is necessary to use speeds of a few millimeters per minute, which approximate speeds employed in induction zone melting of low-melting metals. An apparatus for arc zone melting with molten-zone advance speeds of a few millimeters per minute was therefore designed. Author

N65-23550 Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
LIGHT METALS [LEICHTMETALLE]
18 Dec. 1964 59 p refs In GERMAN Conf. Proc. of the Light Metals Sub-Comm. and the DVS Working Group "Loten" Augsburg, 12 Jun. 1964
(DLR-MITT.-64-07) Available from ZLDI, Munich: 20 DM

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6. SOME SPECIFIC SOLDERING AND WELDING PROBLEMS IN RARE METALS TECHNOLOGY A. Keil p 38–42 refs (See N65-23556 13-15)
7. THE BRAZING OF TITANIUM/ALUMINIUM COMBINATION G. Metzger p 42–51 refs (See N65-23557 13-15)

N65-23551 Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
STRESS PROBLEMS AND BINDING PROCESSES OF SOLDERING [FESTIGKEITSPROBLEME UND BINDEVORGANGE BEIM LOTEN]
J. Colbus *In its* Light Metals Dec. 1964 p 1–12 refs In GERMAN (See N65-23550 13-15) Available from ZLDI, Munich: 20 DM

Wetting, bonding, and diffusion are discussed as the basic elements of soldering. The addition of silicon to the brazing spelter reduces the zinc oxidation and the wetting extent and

produced always an intermediate layer of a thickness proportional to the silicon content of the solder. Additions of small amounts of phosphate reduced the elasticity of silver and brass soldering, and impact-bending tests showed a marked loss of elasticity for silicon-containing solders due to increased formation of an intermediate layer. Cyclic endurance bending tests proved that silver soldering with the proper wetting agents had higher stability than brass solders. Transl. by G.G.

N65-23552 Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
METALLOGRAPHIC, PHYSICAL AND CHEMICAL ASPECTS OF BRAZING [METALLKUNDLICHE, PHYSIKALISCHE UND CHEMISCHE GESICHTSPUNKTE BEIM HARTLOTEN]
W. Mahler *In its* Light Metals Dec. 1964 p 13–22 refs In GERMAN (See N65-23550 13-15) Available from ZLDI, Munich: 20 DM

The fundamental principle for brazing is that the stress boundary area between the liquid solder under the wetting agent has to be overcome by the adhesion stress γ H in order to expand. A method to measure the adhesion stress γ H between the basic material and the liquid solder is described that can be extrapolated to determine the capillaric inflation pressure for a number of different gap widths. Wetting-agent-free brazing of Fe in a reducing gas atmosphere of 1100° C resulted in solder capillaries of 1μ to 10μ. Brazing of silver, cadmium, copper, and zinc with steel did not produce a diffusion zone of satisfactory ductility. Brazing of 18/8-chromium–nickel–steel produced some corrosion through the chlor ion contained in the solder. Transl. by G.G.

N65-23553 Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
EXPERIENCES WITH ZIRCONIUM-5%-BERYLLIUM SOLDER IN THE SOLDERING OF ZIRCALOY [ERFAHRUNGEN MIT DEM ZIRKONIUM-5%-BERYLLIUM-LOT BEIM LOTEN VON ZIRCALOY]
W. Zeller *In its* Light Metals Dec. 1964 p 22–25 refs In GERMAN (See N65-23550 13-15) Available from ZLDI, Munich: 20 DM

Described is the high-frequency soldering of zircaloy-2 parts for a nuclear reactor by a zirconium-5%-beryllium solder of 0.5-mm grain size in a high vacuum. The solder melting temperature was kept above the α-β-transformation phase for zircaloy and the gap width between the two parts was kept at 0.05 to 0.1 mm. Corrosion and tension testing of the joint parts showed excellent resistance to both. Transl. by G.G.

N65-23554 Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
SOLDERING WITH NICKEL-CHROME SOLDER AND THE APPLICATION OF PALLADIUM SOLDER [LOTEN MIT NICKEL-CHROM-LOTEN UND DIE VERWENDUNG DER PALLADIUMLOTE]
H. Holetzko *In its* Light Metals Dec. 1964 p 26–31 refs In GERMAN (See N65-23550 13-15) Available from ZLDI, Munich: 20 DM

Hard-soldering of even-temperature and heat-resistant metal alloys in a reducing atmosphere is discussed with emphasis on 18/8-chromium–nickel–steels, and on pure chromium steels. The chemical composition and possible applications of important nickel-containing materials are presented in a table, and an evaluation of their characteristics led to the conclusion that hard-soldering with a nickel–chromium base for alloys of the nickel–chromium–cobalt group is recommended when highest stability under operating conditions is required. Palladium-containing solders are recommended when good elasticity together with heat resistance is essential. Transl. by G.G.

N65-23555 Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
SUBSTANCE-LOCKING BONDS IN THE MANUFACTURING OF NUCLEAR REACTOR FIRING ELEMENTS [STOFFSCHLUSSIGE VERBINDUNGEN BEI DER HERSTELLUNG VON KERNREAKTOR-BRENNELEMENTEN]
G. Schneider *In its* Light Metals Dec. 1964 p 32–37 refs In GERMAN (See N65-23550 13-15) Available from ZLDI, Munich: 20 DM

Discussed is the utilization of various cladding materials for nuclear reactors that permit the heat transfer between the fuel and casing into the cooling substance. Emphasis is placed on the following material combinations: Al 99.5 compound and its aluminum alloys; uranium; aluminum–uranium alloys; uranium-rich alloys; combinations of Zircaloy-2 with uranium-rich alloys; steel combinations; and graphite in bond with layered uranium carbide particles. Some examples of diffusion cladding processes for firing elements of flat structure, rod shape, hollow pipes, and spheres are presented.
Transl. by G.G.

N65-23556 Forschungsinstitut für Edelmetalle und Metallchemie, Schwaebisch Gmuend (West Germany).
SOME SPECIFIC SOLDERING AND WELDING PROBLEMS IN RARE METALS TECHNOLOGY [EINIGE SPEZIELLE LOT- UND SCHWEISSPROBLEME IN DER EDELMETALLTECHNIK]
A. Keil *In* WGLR Light Metals Dec. 1964 p 38–42 refs In GERMAN (See N65-23550 13-15) Available from ZLDI, Munich: 20 DM

Different welding processes and their characteristics are reviewed. Considered are processes using localized heating above the melting point of the basic material, heating of the basic material below the melting point and subsequent processing, and the cold rolling process with its considerable enlargement of the contacting surfaces. The production of a silver–copper sheet through hot rolling of the two foils at 800° C is described. Examination of the produced profile revealed an eutectic film at the common boundary. The difference of brazing above 425° C and soldering below 425° C of metals, and the various soldering methods are presented. Soldering in a vacuum permits the utilization of ceramics after proper preparation. Transl. by G.G.

N65-23557 Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
THE BRAZING OF TITANIUM/ALUMINIUM COMBINATION [DAS HARTLOTEN DER KOMBINATION TITAN/ALUMINIUM]
G. Metzger *In its* Light Metals Dec. 1964 p 42–51 refs In GERMAN (See N65-23550 13-15) Available from ZLDI, Munich: 20 DM

The reaction between titanium and the brazing combinations of silver–aluminum, aluminum–zinc, and aluminum–silicon alloys with aluminum was investigated at temperatures and durations similar to brazing conditions. Successful brazing combinations were found for titanium–aluminum and titanium–AlMgSi through dipping of the preheated samples into a hot salt bath at 605° to 615° C and 590° to 600° C, respectively; flame brazing in an acetylene-oxygen burner was only partly successful, and brazing in an electrical oven at 625° C was unsuccessful. The tensile strength of the brazed titanium–AlMgSi combination was 22 kp/mm^2 and shear strength was 18 kp/mm^2. Transl. by G.G.

N65-23621# Navy Electronics Lab., San Diego, Calif.
SOUTHERN CROSS INTEGRATED PACKAGING SYSTEM
D. M. Budai 19 Mar. 1965 66 p refs
(NEL-1275; AD-461562)

A program focusing on the design and fabrication of an optimum family of standard enclosures to protect electronic equipment in Navy shipboard environments, is reported. A family of seven free-standing enclosures encompassing unit assemblies with overall heights from 30 to 72 inches was designed. The 72 inch high enclosure is presently the preferred choice for SACOM. All seven enclosures are 24 inches wide by 25 inches deep. The basic standard enclosure consists of an external housing and two serviceable main chassis. Versatility was a prime objective of the basic enclosure design. The enclosures are ideal for modular assemblies and also readily accept a mixture of conventional electronic equipment without modification. With minor modifications, the enclosures can be used for any class of equipment from high power conventional transmitters to completely modularized, high density digital equipments. Preliminary requirements for modules, wiring, connectors, and cooling are included. S.C.W.

N65-23623# Battelle Memorial Inst., Columbus, Ohio.
A SURVEY OF ELECTROFORMING FOR FABRICATING STRUCTURES
W. H. Safranek Huntsville, Ala., Army Missile Command, 1 Aug. 1964 35 p refs
(Contract DA-01-021-AMC-203(Z))
(RSIC-210; AD-461826)

Several high-strength structures have been produced by electroforming, for specific missile and aerospace applications. Several organizations electroformed nickel with ultimate tensile strengths of 90 000 to 100 000 psi, or more. Tough (notch insensitive), 200 000-psi nickel has been electroformed by one or two organizations. This report describes advantages and limitations of electroforming, summarizes available property data of materials, and discusses electroforming conditions that must be maintained for good control of structural properties. Author

N65-23656*# RAND Corp., Santa Monica, Calif.
TWO MODELS FOR TIME CONSTRAINED MAINTENANCE
Ernest M. Scheuer Apr. 1965 17 p refs
(Contract NASr-21(08))
(NASA-CR-62697; RM-4518-NASA) CFSTI: HC $1.00/MF $0.50

This memorandum derives the probability that all initially inoperative systems will function at a fixed time after repair begins. Two maintenance disciplines are considered: in the first, no system undergoing repair is turned on until all systems are fixed, then all are turned on simultaneously; in the second, a system is turned on as soon as repaired. In both disciplines only one system can be in repair at a time. It is assumed that failure times and repair times are exponentially distributed with known parameters and that these times are totally independent. Each system is repaired only once. An explicit expression for the optimum time to begin repair is obtained for only the simplest case of one system; however, the probability of all systems functioning at a certain time is given in closed form, so that in a more general case the optimum time can be numerically obtained. The focus is on systems whose operating life is a limited time span. Author

N65-23657# Mechanical Technology, Inc., Latham, N. Y.
SPECTRAL ANALYSIS OF GAS BEARING SYSTEMS FOR STABILITY STUDIES
C. H. T. Pan 15 Dec. 1964 41 p refs
(Contract Nonr-3730(00))
(MTI-64-TR58; AD-610870)

Stability map for a gas-bearing supported rotor can be constructed from the periodic dynamic perturbation solution of the gas bearing equation about the equilibrium condition. A complete frequency range of the perturbation solution is required. Effective system stiffness and damping can be defined in terms of the perturbation solution of the gas bearing. The condition of neutral stability corresponds to the vanishing of the effective damping, yielding the characteristic frequency, and resonance at the characteristic frequency with the equivalent stiffness, yielding the critical mass. An excess of rotor mass causes instability if the effective damping increases with frequency, at the characteristic frequency, and conversely. For unloaded, journal bearings possessing rotational symmetry, the stability map can be constructed from their steady-whirl solutions. An example illustrating the latter case is given in terms of a herringbone-grooved journal bearing. This method of stability analysis is applicable to both thrust and journal bearings for both whirl and pneumatic-hammer instabilities. Author

N65-23669*# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics
THE ROLLING TIRE UNDER LOAD Technical Report No. 2
S. K. Clark Mar. 1965 38 p refs *Its* Rept.-05608-5-T
(Grant NsG-344)
(NASA-CR-62659) CFSTI: HC $2.00/MF $0.50

An elastically supported cylindrical shell is used as a model for the dynamic rolling of a loaded pneumatic tire. Such a model includes many of the effects found in the real tire, such as bending of the tread in the contact patch region, elastic support coming from the inflated sidewalls and loss effects coming from the inherent dissipative properties of the materials used. Methods are presented for calculating the dynamic contact patch areas of such a model, and it is shown that these are influenced considerably by rolling velocity, the constructional parameters of the tire, and its loss characteristics. Dynamic pressure distributions inside these contact patch areas may also be obtained analytically, and techniques are given for doing this. As an example of the use of such a model, an elastically supported cylindrical shell with a viscous loss law is used as a basis for the calculation of the load carrying and drag properties of a pneumatic tire, to the extent that the various tire parameters may be approximated. Author

N65-23762# Bureau of Reclamation, Denver, Colo. Div. of Research
THE EFFECTS OF 1-YEAR AGING ON STEEL-FILLED EPOXY FILLERS BETWEEN CURVED PLATES AND FLAT FLANGES
C. E. Selander and R. E. Good, comp. 6 Nov. 1964 14 p refs
(G-34; AD-456723)

The fillers displayed improved performance with slight increases in strength and greater resistance to bending, attributable to additional curing of the epoxy resins. The steel specimens were originally tested to determine stress distribution from curved plate to flat flange, and the results of aging were compared to the original test results. The comparison showed overall greater resistance to bending and less deflection after aging and an increase in deflection as load increased, which

was considered insignificant since the overall deflection was less than in the original tests. The results indicate that the steel-filled epoxy compounds are excellent materials for distributing the load from curved surfaces to flat surfaces and vice versa and that they could also be used in other instances where formed-in-place fillers are required. Author

N65-23780# Joint Publications Research Service, Washington, D. C.
CYBERNETICS IN THE SERVICE OF COMMUNISM. VOLUME II: QUEUEING AND RELIABILITY THEORY
A. I. Berg, N. G. Bruyevich, and B. V. Gnedenko, ed. 18 May 1965 493 p refs Transl. into ENGLISH of the book "Kibernetiku Na Sluzhbu Kommunizmu, Tom 2, Teoriya Nadezhnosti i Teoriya Massovogo Obsluzhivaniya" Moscow, Energ. Publ. House, 1964 368 p
(JPRS-30128; TT-63-31010) CFSTI: $7.92

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2. METHODS OF INCREASING RELIABILITY A. D. Solov'ye et al p 96–243 refs
3. VARIOUS PROBLEMS IN RELIABILITY THEORY I. N. Kovalenko et al p 244–289 ref
4. INVESTIGATION OF FLOWS OF EVENTS p 290–352 refs
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6. PROBLEMS OF MATHEMATICAL SIMULATION OF COMPUTERS G. A. Aliyev, G. P. Klimov et al p 461–474 refs

N65-23784* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF SQUEEZE FILM BEARINGS
Peter H. Broussard, Jr., John Burch, and Emmett L. Martz *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 20–30 refs (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

The necessary gas pressure is obtained by vibrating one bearing surface in a normal direction at a high frequency, thus alternately squeezing and releasing the gas film between the surfaces. This bearing does not require either external gas supply or high-speed rotation. Described are (1) the theoretical development of the squeeze bearing using Reynolds' equation, and (2) the design of a working model in which a piezoelectric sleeve and end plates provide motion normal to the supported member at all points. Author

N65-23798*# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF LARGE-INTERNAL-SURFACE-AREA NICKEL-METAL PLAQUES Third Quarterly Progress Report, Dec. 19, 1964–Mar. 18, 1965
J. Mc Callum, G. R. Schaer, D. G. Trevethan, and C. L. Faust 8 Apr. 1965 26 p
(Contract NAS3-6003)
(NASA-CR-54385) CFSTI: HC $2.00/MF $0.50

A study designed to complete the fabrication of experimental electrodes for electrochemical evaluation, identify ways to impregnate the experimental electrodes with active cadmium compound, and electrochemically evaluate the experimental electrodes is presented. Porous experimental electrodes with straight-through holes were made with three shapes of pores, four different size holes, and four different thicknesses. Nineteen electrodes have been selected for experimental studies on the effects of pore size, pore shape, electrode thickness, current density, and depth of discharge on energy output and input. Porosity of these electrodes was increased up to 66% by chemically dissolving metal from the stacked and bonded screens. Impregnation studies with the new electrodes showed that a spongy cadmium metal could be electrodeposited within straight-through pores. Chemical impregnation of stacked-screen electrodes, by an eight-cycle process, led to a greater percentage of pore volume filled than was observed with commercial battery plaques. A material balance study of active materials in the negative electrode has shown that elemental cadmium is not always completely oxidized. S.C.W.

N65-23818*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN APPROXIMATE DETERMINATION OF THE EFFECTS OF GEOMETRY ON BALL-BEARING TORQUE AND FATIGUE LIFE
John T. Mayer and Thomas C. Litzler Washington, NASA, May 1965 26 p refs
(NASA-TN-D-2792) CFSTI: HC $1.00/MF $0.50

Existing theoretical analyses were used to calculate ball-spin torque and fatigue life of thrust-loaded ball bearings over a wide range of load, speed, and bearing geometric parameters. The aim was to quantitatively determine the effects of bearing geometry on ball-spin torque and life and to establish design criteria with regard to geometry for rocket turbopump bearings. The following variables were examined for their effect on ball-spin torque and life: contact angle, race curvature, ball size and number, and pitch diameter. Calculations were performed for several bearing geometries corresponding to 50-, 100-, and 150-millimeter bore sizes. The load and speed ranges examined were 1000 to 10000 pounds and 10000 to 25000 rpm, respectively. Results indicated that minor changes in standard bearing geometries can greatly alter torque and fatigue life, and that in some cases a particular change can improve the bearing in both of these operational aspects. Race curvature and ball size had the most pronounced effects on torque and life. Although most geometry changes that reduced torque also reduced fatigue life, a certain degree of optimization can be achieved. General rules were outlined for such an optimization. Author

N65-23819*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS FOR STUDYING BALL SPINNING FRICTION
Steven T. Miller, Richard J. Parker, and Erwin V. Zaretsky Washington, NASA, May 1965 13 p refs
(NASA-TN-D-2796) CFSTI: HC $1.00/MF $0.50

An apparatus was designed to study one aspect of spinning friction based on interfacial slip over the entire ball-race contact area. It is capable of measuring spinning moments of less than 0.01 inch-pound at maximum Hertz contact stresses to over 400000 psi, speeds to 3500 rpm, and under varying contact configurations and conditions. From the torque measurement, a coefficient of spinning friction can be calculated. The apparatus comprises a drive assembly, a deadweight load assembly, a spherical upper test specimen, a cylindrically grooved lower test specimen of varying conformity, a lower test specimen housing assembly incorporating a hydrostatic air-bearing assembly, and a torque-measuring system. In operation, the upper test specimen is loaded against the lower test specimen through the drive shaft assembly by the deadweight load assembly. As the drive assembly is rotated, the upper test specimen rotates against the stationary lower test specimen actuating the torque-measuring system. Preliminary tests showed that the coefficient of spinning friction decreased with increasing maximum Hertz stress to an intermediate stress level. Author

N65-24002# CTS Knights, Inc., Sandwich, Ill.
HIGH PRECISION 5 MC QUARTZ RESONATORS FOR TEMPERATURE CONTROL BETWEEN 20° AND 30° C Report V, 10 Jun.–10 Sep. 1964
[1964] 28 p
(Contract NObsr-89290)
(AD-614433)

The aging for periods of 10 to 28 days of 5th overtone units, operating between +20° and +30° C is discussed. TAB

N65-24003# CTS Knights, Inc., Sandwich, Ill.
HIGH PRECISSION 5 MC QUARTZ RESONATORS FOR TEMPERATURE CONTROL BETWEEN 20° AND 30° C Report VI, 10 Sep.–10 Dec. 1964
[1964] 36 p
(Contract NObsr-89290)
(AD-614434)

Data on the aging of two room-temperature 5th overtone, 5 Mc., quartz resonators are examined in detail to formulate hypotheses about rate of aging. TAB

N65-24088# North American Aviation, Inc., Columbus, Ohio.
EVALUATION OF INTEGRALLY CURED ADHESIVES Final Report, Jan.–Dec. 1964
J. P. Tipton, H. B. Corson, R. P. Steen, R. K. Newsome, and J. G. Hutchinson Wright-Patterson AFB, Ohio, AF Mater. Lab., Feb. 1965 79 p refs
(Contract AF 33(615)-1182)
(NA-64H-477-4; AFML-TR-19; AD-461626)

Comparative test data are presented on complete qualification to MIL-A-005090E and MIL-A-25463 for an electrically cured adhesive system and the same adhesive cured by conventional methods. Power requirements for various configurations are established. Test procedures, results and a stress analysis of four full-size prototype aircraft assemblies bonded with the electrical curing adhesive system are described. The strengths produced with electrically cured adhesives are much stronger than those normally required for aircraft design. The strengths developed in the prototype assemblies were approximately 800% at peak performance of a Mach 2 aircraft. High strength thermosetting adhesives can now be cured in a room temperature environment where the only facilities required for this operation would be electrical power equipment and a monitoring device. Author

N65-24181 Joint Publications Research Service, Washington, D. C.
CONCERNING THE MODERNIZATION OF ONE-SPINDLE AUTOMATIC TURRET LATHES APPLICABLE TO CONDITIONS OF SMALL-SERIES PRODUCTION
A. M.-Z. Valitov *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 240–245 ref (See N65-24150 13-09) CFSTI: $6.00

A method of modernizing automatic machine tools is examined that can be used in small-series and individual production. Author

N65-24212# Aberdeen Proving Ground, Md. Army Coating and Chemical Lab.
DEVELOPMENT OF A LOW COST SOLAR HEAT REFLECTING AND LOW VISIBILITY COATING Final Report
Melvin H. Sandler 10 Mar. 1965 13 p refs
(CCL-178; AD-613019) CFSTI: $0.50

This report covers the development of an experimental low cost green solar reflectant and low visibility coating for use on missile systems. The currently specified enamel based on a special and single source pigment, cobalt titanate, has a raw material cost of approximately $9 per gallon compared to $1.50 per gallon for the experimental material. In addition, the test data indicated the experimental material to have a 2° to 3° F advantage over the currently specified material. Author

N65-24223# Sandia Corp., Albuquerque, N. Mex.
DETACHED LEVER ESCAPEMENT STUDY
J. N. Shinkle May 1965 43 p
(SC-RR-65-57) CFSTI: $2.00

The torque regulation range of detached lever escapements is studied. Because the torque limits of a detached lever escapement are determined by the physical limits on the permissible balance wheel amplitude, a theoretical analysis which defines the balance wheel amplitude as a function of the applied torque is presented. It includes the effects of a balance wheel braking mechanism used for limiting balance wheel amplitude and the effects of changing such basic variables as balance wheel pivot diameter, pivot friction, balance wheel weight, escape wheel inertia, and beat rate. This analysis led to changes in the regulating capacity of the test escapement. Experimental data are presented to verify the analysis and to show the improvement after indicated changes were made. Other mathematical analyses show the effects on timekeeping of pivot friction and of balance wheel braking action—negligibly small for ordnance applications. Other experimental analyses show that balance wheel windage effects are of minute proportions and that the radial thrust applied to the balance staff by the hairspring is of sufficient magnitude to warrant consideration. Author

N65-24304*# Army Biological Labs., Fort Detrick, Md. Physical Defense Div.
COMPARISON OF THE LEVEL OF MICROBIAL CONTAMINATION ON STAINLESS STEEL, ALUMINUM, GLASS, AND LUCITE Protection Branch Report of Test No. 15-65
Dorothy M. Portner 8 Apr. 1965 4 p refs
(Contract NASr-35)
(NASA-CR-62863) CFSTI: HC $1.00/MF $0.50

Microbial contamination data were obtained on 2-inch strips of stainless steel, aluminum, glass, and lucite. The surfaces of these materials were exposed to air at room temperature for 20 days, and the number of microorganisms per square foot was calculated in order to make a comparative study of the contamination level on each surface. A table of the results is presented. The data indicated that all four surfaces would be satisfactory for monitoring microbial contamination in any clean room that meets the Federal specification. R.C.S.

N65-24305*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
INVESTIGATE METHODS OF FABRICATING AND JOINING LARGE SANDWICH SEGMENTS FOR FORMING COMMON DOMES Monthly Report, 1–31 Oct. 1964
A. C. Robertson [1964] 18 p
(Contract NAS8-11648)
(NASA-CR-62867; SM-48069) CFSTI: HC $1.00/MF $0.50

Suitable flat panel test specimens and controls for testing welded joints on the liquid hydrogen (LH_2) side of the common bulkhead were completed and underwent compression testing at ambient and −100° F. A wide variation was found between the failure loads of the scalloped doubler joint and the laminated doubler joint. Premature failure of the latter was caused by contamination of the bond line of the facing skins; a substrength bond was made, causing doubler buckling at the skin

joints. The laminated doubler scored lower than the scalloped doubler at both temperature environments, and two of its test specimens failed to meet the basic strength requirements of 40 500 lb at ambient temperature. The design and initial drawing of the subscale bulkhead has been completed for all three types of joints. Layout and basic geometry for several different joint configurations of the full-scale bulkhead were derived. G.G.

N65-24317# Atomic Weapons Research Establishment, Aldermaston (England).
A STUDY OF THE HANDLING, THE MECHANICAL PROPERTIES AND CRYSTAL STRUCTURE OF SILICON NITRIDE WHISKERS
C. A. Calow and B. Begley Sep. 1964 14 p
(AWRE-0-70/64)

This report describes the separation of individual whiskers from the original whisker wool, the metallizing of whiskers with nickel and silver, tensile testing and X-ray structure. Author

N65-24377*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF A SEALED BRUSHLESS DC MOTOR
Philip A. Studer Washington, NASA, May 1965 12 p refs
(NASA-TN-D-2819) CFSTI: HC $1.00/MF $0.50

Sealed brushless dc instrument motors for space application have achieved performance levels that indicate no size or efficiency penalty remains, while increased independence of the environment is secured through photoelectronic commutation. The motors reach efficiencies of 65%. A typical unit develops 0.25 in.-oz of torque at 3000 rpm with a power input of one watt. A stall torque of 3.25 in.-oz reduces the mechanical time constant to an extremely low value. The predicted reliability for one year of continuous operation is 94.4%. Sealing of the windings and electronics prevents outgassing from affecting nearby sensitive instrumentation. This type of motor should be considered for space applications where high torque, efficiency and reliability as well as minimal outgassing are important factors. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N65-23435# Library of Congress, Washington, D. C. Aerospace Technology Div.
GIANT LASER PULSES WITH A PHOTOCHEMICAL SHUTTER
John G. Kourilo *In its* Foreign Sci. Bull., Vol. 1, No. 5 May 1965 p 21–23 refs (See N65-23432 13-34)

A review is presented of two Soviet studies on the role of metal-phthalocyanines in producing giant pulses from a ruby laser. A recent Soviet study established the effect of various metal components and concentration of the solutions on the characteristics of the laser pulses. Bleaching of the solutions by the coherent laser emission was interpreted as the result of accumulation of pigment molecules in the metastable (triplet) state. Author

N65-23491# Texas Univ., Austin. Quantum Electronics Research Lab.
QUANTUM ASPECTS OF ELECTRICAL SCIENCE Final Report, 1 Apr.–30 Sep. 1964
Arwin A. Dougal 1 Oct. 1964 104 p refs
(Grant AF-AFOSR-487-64)
(AFOSR-65-0248; AD-611338)

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4. OUTPUT CHARACTERISTICS OF A HE-NE OPTICAL MASER OPERATING AT 3.39μ R. B. Allen and A. A. Dougal p 61–75 refs (See N65-23495 13-16)
5. A TIME RESOLVED STUDY OF SECOND BREAKDOWN IN SILICON SWITCHING TRANSISTORS D. K. Ferry and A. A. Dougal p 76–83 refs (See N65-23496 13-26)
6. POPULATION INVERSION AND OPTICAL MASER OSCILLATIONS IN MOLECULAR GASES R. B. Allen and A. A. Dougal p 84–91 refs (See N65-23497 13-16)

N65-23492 Texas Univ., Austin. Quantum Electronics Research Lab.
CHARACTERISTICS OF COUPLED OPTICAL RESONATORS
Raymond B. Allen and Arwin A. Dougal *In its* Quantum Aspects of Elec. Sci. 1 Oct. 1964 p 1–25 refs (See N65-23491 13-16)

The characteristics of coupled resonator systems were studied experimentally and analytically. It was observed that three different situations prevail depending on the degree of coupling between the resonators. The degree of coupling may be specified in terms of a coupling factor γ such that $\gamma \geq R_3/R_2$ where R_i is the reflectivity of mirror M_i. The three situations which prevail may be noted as weak coupling ($\gamma \sim 0$), intermediate coupling ($\gamma \sim 1$), and strong coupling ($\gamma > > 1$). Weak coupling is approaching the situation where the external mirror M_3 is absent from the system, i.e., $R_3 = 0$. For this condition experimental results confirmed that the laser output beam is unchanged by slight variations in the optical path length of the external resonator. Strong coupling is approaching the situation where the common mirror M_2 is absent from the system, i.e., $R_2 = 0$. Slight variations in the external resonator optical path again do not modulate the output beam intensity but change the frequency of oscillation. For intermediate coupling, interference effects dominate and the laser output intensity is effectively modulated by small variations in the external resonator optical path length. E.E.B.

N65-23494 Texas Univ., Austin. Quantum Electronics Research Lab.
EXPERIMENTS IN DIFFRACTION IMAGING OF COHERENT LIGHT IN THE MICROSCOPE
William H. Carter and Arwin A. Dougal *In its* Quantum Aspects of Elec. Sci. 1 Oct. 1964 p 34–60 refs (See N65-23491 13-16)

Several mathematical models of diffraction imaging are discussed based on the solutions of Maxwell's equations. The complexities of the mathematics require simplifying assumptions about the light field. The form of light which lends itself most readily to this treatment is a monochromatic, spatially coherent, plane wave. Since this is very closely realized by a gas laser beam, experiments in diffraction imaging of coherent

light in the microscope were performed with a He–Ne gas phase laser oscillating at the 6328 Å line. This laser produces about 0.1 mW when operated with hemispherical interferometer and about 1 mW when operated with confocal. A photomicrograph taken of the Fresnel diffraction pattern formed in the object plane with laser illumination of the microscope substage condenser is shown. It was found that defocusing the microscope did not destroy the image formed by laser light nearly so readily as a conventional white light image. This effect is shown clearly by photomicrographs of sugar crystals illuminated with both light sources. E.E.B.

N65-23495 Texas Univ., Austin. Quantum Electronics Research Lab.

OUTPUT CHARACTERISTICS OF A HE–NE OPTICAL MASER OPERATING AT 3.39μ

Raymond B. Allen and Arwin A. Dougal *In its* Quantum Aspects of Elec. Sci. 1 Oct. 1964 p 61–75 refs (See N65-23491 13-16)

A study of the effects on the output power of gas mixture ratio, total gas pressure, resonator geometry, and mirror reflectivities is reported for a He–Ne optical maser system operating at 3.39 microns. The primary purpose of the study was to maximize the 3.39-micron output of the laser within the limitations of the available mirrors. Among the characteristics observed was the ease with which lasing action at 3.39μ could be obtained even where large losses were present. In order to obtain oscillation on a typical low gain line (0.6328μ) a stable resonator configuration with low diffraction losses was required. It has been observed that laser action takes place for mirror separations of over 15 meters using a stainless steel plane mirror and a 152-cm aluminized mirror. For this particular system, any mirror separation over 152 cm corresponds to a high diffraction loss unstable configuration. Substantial output of a few milliwatts was obtained with this arrangement. The power output was observed to go up when two plane mirrors are used over this distance. The maximum output was 16 mW for 10 μsec duration pulsed and 10 mW continuous. Also, 2 mm Hg was the optimum pressure; the optimum ratio 5:1, He–Ne; and plane-parallel the optimum mirror configuration. E.E.B.

N65-23497 Texas Univ., Austin. Quantum Electronics Research Lab.

POPULATION INVERSION AND OPTICAL MASER OSCILLATIONS IN MOLECULAR GASES

Raymond B. Allen and Arwin A. Dougal *In its* Quantum Aspects of Elec. Sci. 1 Oct. 1964 p 84–91 refs (See N65-23491 13-16)

The laser system previously reported was fabricated. Photograph and block diagram are included. The radius of curvature was changed from 1.35 m to 2 m because of the ready availability of the 2-meter mirrors. With a cavity separation of 1.35 m, the 2-meter radius of curvature mirrors form a stable system which makes more efficient use of the available volume of active material than the originally proposed confocal system with only a slight increase in the angular alinement requirements. Also, the peak reflectivity of the mirrors was changed from 3371 Å because of the difficulty encountered in obtaining such mirrors. Another change in the original system is the addition of a second variable leak valve and associated glass bulb. This provides the capability of investigating the laser characteristics of various gas mixtures. The details of the construction of the cathode, anode, and pumping arrangements are shown. E.E.B.

N65-23622# Army Missile Command, Huntsville, Ala. Electromagnetics Lab.

A LITERATURE SURVEY ON THE ATMOSPHERIC EFFECTS ON THE PROPAGATION OF 1.06 MICRON LASER RADIATION

Eddie L. Roy and George A. Emmons 8 Feb. 1965 58 p refs (RE-TR-65-3; AD-461778)

A literature survey on the effects of the atmosphere on laser energy propagation was performed. This memorandum presents the results. Special emphasis is given to the spectral region at 1.06 microns, since this is the region of interest for LASAM system applications. Transmission, absorption, scattering, and seeing effects are discussed for various weather conditions. Author

N65-23723 Joint Publications Research Service, Washington, D. C.

THE INDUSTRIAL POSSIBILITIES OF LASERS

V. S. Zuyev *In its* The Use of Electron Beams and Lasers in Ind. 4 May 1965 p 9–16 (See N65-23721 13-34)

The capacity and applications of ruby and neodymium glass lasers are discussed. The bundle of light radiated by a laser can be focused onto an area determined by the focal length of the focusing lens and the angle of divergence of the laser beam. The diameter of the spot cannot be less than the wavelength of the light beam used. A ruby laser produces a diameter of 0.7 microns and the neodymium laser produces a diameter of 1.06 microns. Laser-pumping lasers can convert electrical energy directly into light with 20% to 30% coefficiency. Of primary importance is the problem of stability of lasers under the influence of superpowerful light impulses. A laser machine was created and used to make a hole in a diamond die in less than a fraction of a second, and lasers were successfully used in the manufacture of contacts in miniature semiconductor instruments as well as in emission analysis of minerals. It was found that a laser with a huge impulse is less effective for burning holes than a laser under ordinary conditions, because the energy of the light impulse is absorbed by the plasmoid forming above the surface of a substance. G.G.

N65-23837 Library of Congress, Washington, D. C. Aerospace Technology Div.

SOVIET LASER RESEARCH

Charles Shishkevish *In its* Foreign Sci. Bull. Apr. 1965 p 1–13 refs (See N65-23836 13-34) CFSTI: HC $3.00/MF $0.75

This review of Soviet laser research summarizes the important aspects of laser research published in Soviet scientific journals from 1961 to 1964 and a few of the more important contributions made before 1961. Semiconductor lasers are discussed in considerable detail. In view of the relatively large number of papers dealing with lasers, only a few references are listed. Author

N65-24195# Corning Glass Works, N. Y.

GLASS LASER RESEARCH Semiannual Technical Report, Jul.–Dec. 1964

R. D. Maurer, N. F. Borrelli, M. E. Vance, G. E. Stong, S. D. Sims (TRG, Inc.) et al 30 Jan. 1965 99 p refs (Contract Nonr-3833(00)) (AD-612964)

Efficient utilization of neodymium glass lasers is investigated. Pump light damage to the cylindrical surface was due to scratches and imbedded particles. This damage is eliminated by chemical treatment of the surface. The mechanism of solarization is delineated, and the problem eliminated by pump light

filtering with a minimal 15% loss in output. Improved performance was attempted by varying the external conditions. The efficiency of various pump bands is given in detail for matching light sources. Output is further maximized by varying the cavity coupling. From these output coupling data the first dynamic internal loss values for a near-perfect static medium are reported. They are about three times as large as the static losses. A detailed investigation to find an accurate value of the gain cross section (without assuming degeneracies) shows that a straightforward spectroscopic study can yield this quantity within a factor of two. Gain measurements in an amplifier are determined for eventual translation, through the gain cross section, into energy storage and real pump efficiency. Data are given on the time-resolved distortion of a pumped rod to determine the magnitude of this problem in preventing diffraction-limited operation. Author

N65-24343# Autonetics, Anaheim, Calif. Research, Engineering, and Reliability Div.
OPTICAL LASER AMPLIFIERS
E. L. Steele and W. C. Davis 1 Jun. 1964 13 p refs Presented at the IEEE 6th Region Ann. Conf., Salt Lake City, 29 Jul. 1964

A theoretical model for a laser amplifier is discussed in which the excited electron density in a host laser material is stimulated to radiate, thereby providing a source of optical energy. The photon density in the laser material is described by a continuity equation with this source term included and a gain expression derived for an amplifier system. The theoretical model is then compared with experimental data taken on a ruby amplifier driven by a Q-switched oscillator with stable output. The properties of the oscillator are due, in part, to a newly developed output coupler and a spinning rooftop prism for Q-spoiling. The gain of the system described is found to saturate at values between 5 and 7. This saturation appears to be due to a saturation effect caused by complete pumping of the system rather than being dependent upon the energy input to the flash lamp pump. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N65-23375# Joint Publications Research Service, Washington, D. C.
SOVIET TITANIUM ALLOYS
19 Apr. 1965 56 p Transl. into ENGLISH from Russian periodicals
(JPRS-29652; TT-65-30765) CFSTI: $3.00

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3. COMPOSITION AND STRUCTURE OF TITANIUM ALLOY INGOTS IN THE SHRINKAGE CAVITY ZONE L. A. Yelagina p 11–18 ref (See N65-23378 13-17)

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7. WELDING TITANIUM ALLOYS WITH NICKEL-BASE ALLOYS I. G. Gorin p 42–53 (See N65-23382 13-17)

N65-23376 Joint Publications Research Service, Washington, D. C.
STRENGTHENING ALLOY VT15 BY HEAT TREATING
A. I. Khorev, S. G. Glazunov, and A. M. Legkodukh *In its* Soviet Titanium Alloys 19 Apr. 1965 p 1–4 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 2, Feb. 1965 p 50–52 (See N65-23375 13-17) CFSTI: $3.00

The investigation of thermally strengthened 7.08Mo–11.1Cr–3.15Al titanium alloy is reported. The presence of a substantial amount of the beta-stabilizing elements molybdenum and chromium in the alloy makes it possible to fix 100% of the beta phase by quenching in water and cooling in air. This phase is isothermally unstable and breaks down when heated, liberating dispersed particles of the alpha phase accompanied by a substantial increase in the strength of the alloy. In addition to the alpha phase, the intermetallic phase $TiCr_2$ may be deposited. On the basis of the investigations reported, a new system was recommended for strengthening heat treating with quenching from the alpha–beta region from 680° C, close to the boundary of the polymorphic transformation, followed by aging at 450° to 500° for 25 hours. This system insures a more uniform occurrence of the aging process in the alloy and gives better combinations of strength and plasticity in comparison with the strengthening heat treatment with quenching from the beta region. E.E.B.

N65-23377 Joint Publications Research Service, Washington, D. C.
DESIGN STRENGTH OF HEAT-TREATED TITANIUM ALLOYS
S. G. Glazunov, A. I. Khorev, and V. N. Moiseyev *In its* Soviet Titanium Alloys 19 Apr. 1965 p 5–10 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 6, Jun. 1964 p 2–5 (See N65-23375 13-17) CFSTI: $3.00

The results of investigations of the alloys VT6S, VT15, and VT16 under biaxial loading are presented. The work was conducted on cylindrical model samples, made out of pressed pipes. Ingots 40 kg in weight were smelted in a laboratory furnace. Cups with a diameter of 195 mm, with an opening 95 mm in diameter, were bored out from the ingots, subjected to induction heating, and then pipes were pressed on a 2000-ton horizontal press (P_{max} = 200 atm) from a container 200 mm in diameter. The chemical composition of the ingots, temperature to which the cups were heated for pressing, and time of exposure in the furnace, as well as the medium in which the pipes were cooled after pressing, are given. The possibility of obtaining a design strength of tanks prepared from pressed pipes of heat-treated titanium alloys of up to 124 to 147 kg/mm^2 was demonstrated. The use of high-temperature mechanical treatment makes it possible to increase the design strength of tanks from the alloy VT16, and to substantially improve their structure. Author

N65-23378 Joint Publications Research Service, Washington, D. C.
COMPOSITIONS AND STRUCTURE OF TITANIUM ALLOY INGOTS IN THE SHRINKAGE CAVITY ZONE
L. A. Yelagina *In its* Soviet Titanium Alloys 19 Apr. 1965 p 11–18 ref Transl. into ENGLISH from Metalloved. i. Term. Obrabotka Metal. (Moscow), no. 6, Jun. 1964 p 23–27 (See N65-23375 13-17) CFSTI: $3.00

The composition and structure of the metal in the zone of the shrinkage cavity were studied by chemical, spectral, and metallographic methods. Microhardness was also measured. It was found that ingots of the series titanium alloys with a comparatively small interval of crystallization were characterized by concentrated closed shrinkage cavities with no sharp variations of the structure and hardness in the zone of the cavity. Removal of the cavities for these alloys during the process of deformation was recommended. Further, in ingots of alloys with a very large interval of crystallization, characterized by diffuse shrinkage cavities, the cells communicating with the furnace atmosphere may be oxidized, resulting in the cavities not being removed. E.E.B.

N65-23379 Joint Publications Research Service, Washington, D. C.
INFLUENCE OF ALLOYING ON THE THERMAL EXPANSION OF TITANIUM
S. F. Kovtun and R. A. Ul'yanov *In its* Soviet Titanium Alloys 19 Apr. 1965 p 19–26 refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 17, no. 2, Feb. 1964 p 263–268 (See N65-23375 13-17) CFSTI: $3.00

The results of experimental investigations of the influence of alloying of titanium with aluminum, molybdenum, chromium, rhenium, palladium, tantalum, lanthanum, and other elements on its thermal expansion are cited. The temperature dependences of the coefficients of the alloys were determined. The irreversible change in form of titanium, zirconium, and certain alloys during cyclic thermal influences was studied. Thermal expansion determines the change in the shape and dimensions of parts with variation of the temperature, creation of supplementary thermal stresses; and in the presence of a cyclic thermal influence, it determines the magnitude of the residual shape change. The magnitude of thermal expansion is estimated by the thermal coefficient, depending on the chemical nature of the metal, and indirectly characterizes the magnitude of the interatomic bonds. According to the Grüneisen equation, when the volume of the metal is increased by 6% in comparison with the volume occupied at absolute zero, the forces of cohesion among the atoms of the space lattice are so weakened that the metal melts. The higher the melting point, the lower the coefficient of thermal expansion, since a 6% increase in the volume occurs in this case within a broader temperature interval. Hence, more refractory transition metals possess comparatively low coefficients of thermal expansion.
Author

N65-23380 Joint Publications Research Service, Washington, D. C.
EFFECT OF ALLOYING ON THE ELECTRICAL RESISTIVITY OF TITANIUM
R. A. Ul'yanov and S. F. Kovtun *In its* Soviet Titanium Alloys 19 Apr. 1965 p 27–34 refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 17, no. 4, 1964 p 505–511 (See N65-23375 13-17) CFSTI: $3.00

Results of experimental investigations of the influence of alloying of titanium alloys with aluminum, molybdenum, chromium, rhenium, palladium, tantalum, and lathanum on the electrical resistivity of these alloys within the temperature interval from −196° to 1250°, are presented. In the case of alloying of titanium in the region of solid solutions, the change in the electrical resistivity and hardness of the alloys is determined by the chemical nature of the alloying element and by the ratio of its atomic diameter to that of titanium. Elements with a greater difference in the atomic diameters and chemical properties produce a greater change in the hardness and electrical resistivity. When the temperature is raised, the temperature coefficient of the electrical resistivity of titanium and its alloys decreases; the higher the concentration of the alloying element, the stronger the decrease. When the phase composition of the alloys changes as a result of alloying, the electrical resistivity is determined by the resistivity of the phases and by their quantitative ratio. Author

N65-23381 Joint Publications Research Service, Washington, D. C.
ELASTIC CONSTANT OF TITANIUM–NIOBIUM ALLOYS
S. G. Fedotov and O. K. Belousov *In its* Soviet Titanium Alloys 19 Apr. 1965 p 35–41 refs Transl into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 17, no. 5, May 1964 p 732–736 (See N65-23375 13-17) CFSTI: $3.00

Elastic constants of alloys of titanium with up to 60% by weight niobium were measured by a dynamic method. It was established that the metastable phases formed upon quenching greatly influence the variation of the elastic constants. On the basis of an investigation of the temperature dependence of the modulus of normal elasticity of the quenched alloys, a scheme is cited for the decomposition of the unstable β-solid solution. Author

N65-23382 Joint Publications Research Service, Washington, D. C.
WELDING TITANIUM ALLOYS WITH NICKEL-BASE ALLOYS
I. G. Gorin *In its* Soviet Titanium Alloys 19 Apr. 1965 p 42–53 Transl. into ENGLISH from Svarochnoye Proizvodstvo (Moscow), no. 12, Dec. 1964 p 25–28 (See N65-23375 13-17) CFSTI: $3.00

Results of experiments on the welding and brazing of joints of the titanium alloys OT4-1 with the nickel-base alloy EI894 are presented. Satisfactory results in the welding of titanium alloys with nickel alloys can be obtained through the use of intermediate inserts of niobium and beryllium bronze in argon-arc welding and with the use of niobium or molybdenum in contact welding. It should be assumed that after development of the production of the bimetal (titanium–stainless steel with a shearing strength of 4 to 5 kg/mm^2), the welding of titanium alloys with chromium–nickel alloys and steels with the use of inserts of bimetal will be the most widespread and cheapest method. Author

N65-23421 Joint Publications Research Service, Washington, D. C.
ONE-DIMENSIONAL CREEP OF EI-257 STEEL IN THE PRESENCE OF A VARIABLE LOAD COMPONENT
A. M. Zhukov and G. M. Ivanova *In its* Eng. Journal 26 Apr. 1965 p 198–203 ref (See N65-23402 13-23) CFSTI: $6.00

The effect of temperature and oscillation frequency on creep of steel was investigated. Experiments were undertaken for precise determination of the effect of a variable component upon the creep of steel at 600° C. Each sample was exposed to the appropriate load conditions for 100 hours. The tests were carried out in machines, in which the samples were heated by demountable electric furnaces. Before exposure to load stresses, the temperature was stabilized, which took 24 hours. The calibration was carried out three times at each statistical

stress. Graphs are constructed which give the curves for creepage in the presence of a variable load component and at constant temperature with different load level. Creep curves with a variable load component are somewhat lower than the corresponding curves with a constant load. R.C.S.

N65-23478# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONFERROUS METALLURGY
7 Aug. 1964 228 p Transl. into ENGLISH of Izv. Vysshikh Uchebn. Zavedenii, Tsvet. Met. (Dzaudzhikau), no. 5, 1963 p 1–159
(FTD-MT-64-16; AD-608600)

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18. INTERACTION OF NIOBIUM AND TANTALUM PENTOXIDES WITH SOLUTIONS OF CAUSTIC POTASH AT TEMPERATURES OVER 100° M. A. Orekhov and A. N. Zelikman p 125–136 refs (See N65-23485 13-06)

19. PRODUCTION OF 99.9999%-PURE GALLIUM BY THE METHOD OF FRACTIONAL CRYSTALLIZATION AND ZONAL MELTING E. Papp and K. Soymar p 137–147 refs (See N65-23486 13-06)

20. THE EFFECT OF ALLOYING ON THE THERMAL EXPANSION OF NIOBIUM R. A. Ul'yanov, N. D. Tarasov, and Ya. D. Mikhaylov p 148–154 refs (See N65-23487 13-17)

21. THEORY OF THE CONTINUOUS BENDING OF SECTIONS OF THE OPEN POLYGON TYPE P. I. Polukhin and G. Ya. Gun p 155–166 refs (See N65-23488 13-17)

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26. ALL-UNION CONFERENCE OF ALUMINUM INDUSTRY WORKERS ON ELECTROLYTE COMPOSITION A. I. Belyayev p 205–206

27. A REVIEW OF SHAFT SINKING BY S. G. BORISENKO, L. YA. TARASOV, I. L. KOVALEV, GOSGORTEKHIZDAT, MOSCOW, 1962 N. S. Demin and N. M. Gaponenko p 207–211

N65-23487 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF ALLOYING OF THE THERMAL EXPANSION OF NIOBIUM
R. A. Ul'yanov, N. D. Tarasov, and Ya. D. Mikhaylov *In its* Nonferrous Met. 7 Aug. 1964 p 148–154 refs (See N65-23478 13-17)

Coefficients of linear expansion of niobium and its alloys were determined and their temperature dependence up to 1050° studied. It was found that at concentrations soluble in the solid state in niobium, the alloying elements with a higher coefficient of thermal expansion than niobium increase the coefficient of thermal expansion of the alloys, while those with a lower coefficient of thermal expansion lower the latter for the alloys. The change in the coefficient of thermal expansion increases in direct proportion to the concentration of the alloying elements, while with the same concentrations, it is all the greater, the greater the difference between the coefficients of thermal expansion of the alloying element and niobium. The alloying elements which reduce the coefficient of thermal expansion in most cases raise the recrystallization temperature and strength of alloys at high temperatures.
Author

N65-23488 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF THE CONTINUOUS BENDING OF SECTIONS OF THE OPEN POLYGON TYPE
P. I. Polukin and G. Ya. Gun *In its* Nonferrous Met. 7 Aug. 1964 p 155–166 refs (See N65-23478 13-17)

A theory for the determination of bent profiles whose transverse cross section represents an open polygon with rounded vortexes, is presented. Data on the geometry of the midsurface, bending a flat sheet of unit length, and the use of the Lagrange principle to obtain a variational problem for determining the function and natural length of the deformation focus, are included. Although the theory allows the determination of the basic parameters of the continuous forming process, the concept of a rigidly plastic body limits its range of applicability. In view of computational difficulties, these studies must be confirmed experimentally. S.C.W.

N65-23489 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPRESSIONS FOR THE ANALYTIC DETERMINATION OF FLUID FRICTION CONDITIONS IN DRAWING
I. L. Perlin, V. Ya. Shapiro, and Ye. L. Shkol'nikov *In its* Nonferrous Met. 7 Aug. 1964 p 167–176 refs (See N65-23478 13-17)

Analytic expressions were derived which determine the value of the hydrodynamic pressure in the lubricant preceding the focus of deformation, depending on its geometry, lubrication characteristics, and other process parameters (for the case of drawing of solid profiles and pipes). These dependences are in good agreement with the general theory of hydrodynamics. The computation of the value of the hydrodynamic pressure for various parameters of the drawing process showed that the appearance of conditions of predominantly fluid friction may be assured through the hydrodynamic action of the lubricant wedge formed by the surface of the drawn material and the tool in the zone preceding the focus of deformation. Author

N65-23529# Watervliet Arsenal, N. Y. Bénet R&E Labs.
STRESS-AGING: A NEW TREATMENT FOR ALLOYS. PART ONE: EFFECT ON STANDARD TENSILE PROPERTIES OF STAINLESS STEELS
R. H. Harrington Nov. 1963 58 p refs
(WVT-RR-6313; AD-430978) CFSTI: $1.50

Stress-aging is a new treatment for alloys that results in concurrent increases of proportional limit, 0.1% offset yield strength, percent elongation, and percent reduction of area. In general, for three stainless steels, the proportional limit (conservative measure of practical elasticity) may be increased by 100%, the 0.1% offset yield strength (a design factor) may be increased by 50 000 psi, with concurrent increases of 25% to 40% in percent elongation and 50% in percent reduction of area. Possible stress-aging reactions are discussed relative to the measured changes in properties that have been observed. Similar effects were observed in other iron-base alloys and in copper-base and aluminum-base alloys. Author

N65-23530# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METALLURGY AND METALLOGRAPHY OF PURE METALS
Selected Articles
23 Apr. 1963 59 p refs Transl. into ENGLISH from the book "Metallurgiya i Metallovedeniye Chistykh Metallov, Sbornik Nauchnykh Rabot" Moscow, Gosatomizdat, 1961 p 64–73, 152–162, 175–182, 190–192, 233–248, 284–289
(FTD-TT-62-1288/1+2; AD-409062)

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1. INVESTIGATION OF THE OXIDATION KINETICS OF IODIDE HAFNIUM IN THE TEMPERATURE RANGE FROM 600 to 1000°C A. I. Yevstyukhin, I. I. Korobkov, and I. P. Barinov p 1–13 refs (See N65-23531 13-17)

2. ZONE MELTING OF NIOBIUM BY THE ARC METHOD A. I. Yevstyukhin, V. V. Nikshanov, and I. V. Milov p 14–26 refs (See N65-23532 13-15)

3. INVESTIGATION OF THE OXIDATION KINETICS OF NIOBIUM IN THE TEMPERATURE REGION FROM 500 to 1000°C B. N. Revyakin, I. I. Korobkov, A. I. Yevstyukhin, and V. S. Lyashenko p 27–37 refs (See N65-23533 13-17)

4. MODULUS OF ELASTICITY OF BERYLLIUM AT ELEVATED TEMPERATURES A. N. Semenikhin, P. L. Gruzin, and D. M. Skorov p 38–42 refs (See N65-23534 13-17)

5. DIFFUSION MOBILITY OF LITHIUM IN IRON AND STEELS N. M. Beskorovayniy, V. S. Yeremeyev, and Yu. Ya. Tomasshpolskiy p 42–59 refs (See N65-23535 13-17)

6. THE SOLUBILITY OF METALS IN CARBON Yu. G. Godin, A. I. Yevstyukhin, V. S. Yemelyanov, A. A. Rusakov, and I. I. Suchkov p 60–66 refs (See N65-23536 13-17)

N65-23531 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE OXIDATION KINETICS OF IODIDE HAFNIUM IN THE TEMPERATURE RANGE FROM 600 TO 1000°C
A. I. Yevstyukhin, I. I. Korobkov, and I. P. Barinov *In its* Met. and Metallography of Pure Metals 23 Apr. 1963 p 1–13 refs (See N65-23530 13-17)

The oxidation kinetics of iodide hafnium in oxygen at temperatures from 600° to 1000°C was investigated by the method of continuous suspension on a highly sensitive vacuumized torsion microbalance. Results of the investigation established the following: (1) The oxidation curve of hafnium in the temperature range from 600° to 800°C is expressed by a cubic function of time. (2) At temperatures of 900° and 1000°C, the oxidation curve of hafnium is parabolic for the period of time before the oxide film attains a critical thickness. Subsequent to this, there is cracking of the oxide film and, as a result, an increase in the oxidation rate. (3) The increase in the oxidation rate (break on kinetic curve) is coincident with the transformation of the dark oxide film into a white oxide. Author

N65-23533 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE OXIDATION KINETICS OF NIOBIUM IN THE TEMPERATURE REGION FROM 500 TO 1000°C
B. N. Revyakin, I. I. Korobkov, A. I. Yevstyukhin, and V. S. Lyashenko *In its* Met. and Metallography of Pure Metals 23 Apr. 1963 p 27–37 refs (See N65-23530 13-17)

Kinetic investigation data were obtained on niobium specimens in the temperature range from 500° to 1000°C. Studies on the oxidation of niobium of various melts showed that the oxidation rates varied sharply (to 150%) from one melt to another. This shows that even when present in small quantities (~0.1%), impurities may strongly affect the oxidation kinetics. It was established that the isothermal oxidation process of niobium is described by a linear law in the range of 500° to 1000°C. A reduction in oxidation rate due to a rise in temperature in the range from 550° to 650°C was not observed. It was further established that in the temperature range from 800° to 900°C, the oxidation rate of niobium decreases with increasing temperature as at other temperatures. The transition from α-Nb_2O_5 to β-Nb_2O_5 occurs at these same temperatures. The X-ray observations showed that the scale corresponding to α-Nb_2O_5 forms on niobium specimens undergoing oxidation at temperatures of 500° to 800°C, while the scale consists of β-Nb_2O_5 at temperatures of 900°C

and above. In view of these findings, the presence of a link between the oxidation kinetics and the structure of the oxide on the surface of niobium is assumed. S.C.W.

N65-23534 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODULUS OF ELASTICITY OF BERYLLIUM AT ELEVATED TEMPERATURES
A. N. Semenikhin, P. L. Gruzin, and D. M. Skorov *In its* Met. and Metallography of Pure Metals 23 Apr. 1963 p 38–41 refs (See N65-23530 13-17)

The modulus of normal elasticity of beryllium was measured on heating to a temperature of 800° C. It was established that the variation in the modulus of elasticity of beryllium is linear to a temperature of 600° C. A more rapid decrease in the modulus of elasticity is observed above this temperature. At elevated temperatures, beryllium has a considerably higher modulus of elasticity than zirconium or titanium. The advantage of beryllium at elevated temperatures is still more obvious if we compare the physical properties referred to unit weight. Author

N65-23535 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIFFUSION MOBILITY OF LITHIUM IN IRON AND STEELS
N. M. Beskorovayniy, V. S. Yeremeyev, and Yu. Ya. Tomasshpolskiy *In its* Met. and Metallography of Pure Metals 23 Apr. 1963 p 42–59 refs (See N65-23530 13-17)

The method of flame photometry was applied to determine lithium concentration in technical iron and carbon steels. This is a development of the spectral methods using a photoelement and galvanometer for recording the radiation of a certain substance in place of the usually applied photographic plate. Lithium has considerable diffusion mobility in commercial iron. Its penetration increases sharply in carbon steels due to the presence of carbon. Changes in structures of commercial iron and carbon steels are linked with the diffusive penetration of lithium; they occur only in those volumes where there is a sufficient quantity of lithium as a result of diffusion. Penetration of lithium occurs principally through grain boundaries usually rich in impurities. Lithium exerts a refining influence in carbon and other admixtures in commercial iron and carbon steels. Changes in structures of commercial iron and carbon steels as a result of diffusion of lithium lead to a decrease in density, the appearance of micro- and macrocracks, significant reduction in strength, and embrittlement of the carbon steels. Author

N65-23536 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SOLUBILITY OF METALS IN CARBON
Yu. G. Godin, A. I. Yevstyukhin, V. S. Yemelyanov, A. A. Rusakov, and I. I. Suchkov *In its* Met. and Metallography of Pure Metals 23 Apr. 1963 p 60–66 refs (See N65-23530 13-17)

A method for determining whether high melting metals, such as zirconium and niobium, are soluble in carbon is proposed. This method involves chemically dissolving the carbides to separate the carbon from the carbide mass. The following separation procedure was used: a finely ground alloy powder was passed through a 270-mesh screen and dissolved by heating in a platinum dish in a mixture of hydrofluoric and nitric acids. Here the carbides were dissolved, while the graphite was found to be in the undissolved residue. After washing and drying the powder, the graphite was subjected to X-ray analysis. A similar analysis of spectrally pure carbon was made for comparison. The X-ray and spectral studies did not indicate solubility of zirconium and niobium in carbon. S.C.W.

N65-23547# Joint Publications Research Service, Washington, D. C.
STUDIES ON THE STRUCTURE AND PROPERTIES OF CERTAIN TITANIUM ALLOYS
9 Apr. 1965 17 p Transl. into ENGLISH from the book "Metallovedeniye Titana", Moscow, 1964 p 249–254, 263–267
(JPRS-29498; TT-65-30685) CFSTI: $1.00

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N65-23548 Joint Publications Research Service, Washington, D. C.
EFFECT OF THE CONDITIONS OF PLASTIC DEFORMATION AND SUBSEQUENT TREATMENT ON THE PROPERTIES OF SOME TITANIUM ALLOYS
I. M. Pavlov, Yu. F. Tarasevich, and A. Ye. Shelest *In its* Studies on the Struct. and Properties of Certain Titanium Alloys 9 Apr. 1965 p 1–7 refs (See N65-23547 13-17) CFSTI: $1.00

Effects of plastic deformation and subsequent cooling on the mechanical properties of martensite titanium alloy OT4 and titanium alloys VT6 and VT14 were studied experimentally. Treatment consisted of rolling samples with a rectangular section on a 200 mill, with 20%, 40%, and 60% reductions in area, in the temperature range 500° to 1100° C. For each test three samples were rolled at 0.5 m/sec; one sample was cooled in water, another in asbestos, and another in air. Cooling rate was measured with thermocouples on the surface and at the center of the samples. The hardness data for each alloy, determined on a Brinell press, are shown as a function of rolling temperature, area reduction, and method of cooling; ultimate strength data for alloy OT4 are given as a function of the same variables. It was found that mechanical properties of the titanium alloys were improved by heat treatment, but that subsequent thermal stability was low. J.M.D.

N65-23549 Joint Publications Research Service, Washington, D. C.
SOME RESEARCH ON THE STRUCTURE AND PROPERTIES OF ALLOY VT5-1 DURING PRE-FORGING HEATING
Ya. M. Dityatovskiy, N. M. Pul'tsin, V. B. Pokrovskaya, and V. A. Vinogradov *In its* Studies on the Struct. and Properties of Certain Titanium Alloys 9 Apr. 1965 p 8–14 refs (See N65-23547 13-17) CFSTI: $1.00

Various aspects of the layer which forms in heat treatment of titanium alloy VT5-1 were studied experimentally. Weight gain during preheating for forging was studied in 40-g round samples, and tapered rods were used for investigating changes in thickness, hardness, and structure of the layer. It was found that weight gain increases considerably at temperatures above 800° C and especially above 1100° C. Heating in air at different temperatures resulted in formation of a modified layer whose thickness, microhardness, and structure depend on the holding temperature. Maximum microhardness of the layer is observed on the surface and will increase with rising temperature, and layer thickness increases and attains nearly 0.3 mm at 1200° C. The solid solution of the layer surface zone has an equiaxial grain structure, while the solid solution of the core has either a crib or small-grained nonequiaxial structure. J.M.D.

N65-23591# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
INVESTIGATION OF BONDING IN OXIDE-FIBER (WHISKER) REINFORCED METALS Final Technical Report, 1 Jul. 1962–30 Jun. 1964
Willard H. Sutton 30 Jun. 1964 43 p refs
(Contract DA-36-034-ORD-3768(Z))
(AMRA-CR-63-01/8; AD-455770)

The effects of various additives to nickel on its wetting, its interfacial energy, and its adherence to sapphire (α-Al_2O_3) were investigated by preparing special binary alloys containing 1 atomic percent of Al, Cu, In, Ti, Zr, and Cr. Sessile drop experiments were conducted in vacuo (5×10^{-6} torr) at 1470° to 1550° C in order to observe the contact angles and the degree of wetting. Only the nickel drops containing Ti, Zr, and Cr showed evidence of pronounced chemical reaction with the sapphire substrates. These same compositions had the most significant effects on contact angle and interfacial energy. Shear tests were conducted on solidified sessile drops of nickel and nickel alloys, and shear stresses as high as 25 000 psi were recorded. It is concluded that high strengths between metal and oxide systems can be achieved by optimization of the compositions and chemical reactions of the interfacially active elements. Author

N65-23618# National Gas Turbine Establishment, Pyestock (England).
COMPARATIVE THERMAL FATIGUE TESTS ON NIMONIC 90 TAPERED DISC SPECIMENS WITH AND WITHOUT INTERNAL AIR COOLING
J. T. Roberts Sep. 1963 25 p refs
(NGTE-M-366) (Declassified)

Thermal fatigue tests were conducted on Nimonic 90 tapered disc specimens, heated and cooled in fluidized beds. The steady edge temperature after heating of all discs was 920° C but half of the discs were arranged with jets of cool air impinging on their inner diameters to limit the average temperature of the disc to some 75° C below the edge temperature. The objective was to obtain data which would prove a guidance in assessing the behavior of cooled turbine blades under thermal shock conditions. All the discs were subjected similarly to rapid heating, but half the discs of each type were cooled slowly. During the tests the discs were examined for cracks in their edges. The comparative life of each disc was assessed by the number of cycles required to produce a predetermined degree of crack formation. The discs which had their average temperature maintained at a value below that of their edge required approximately four times as many cycles to produce a standard degree of cracking, irrespective of the rate of cooling. Slow cooling caused about 10% improvement in disc life. Author

N65-23685*# National Aeronautics and Space Administration, Washington, D. C.
SURFACE STRUCTURE AND PROPERTIES OF CHROMIUM NEEDLE CRYSTALS [POVERKHNOSTNAYA STRUKTURA I SVOYSTVA IGOL'CHATYKH KRISTALLOV KHROMA]
B. M. Vasyutinskiy, G. N. Kartmasov, and I. I. Papirov May 1965 13 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 17, no. 6, 1964 p 892–897
(NASA-TT-F-9358) CFSTI: HC $1.00/MF $0.50

The surface structure structure and tensile strength of filamentary chromium crystals (whiskers) prepared by condensation from the vapor phase in vacuum were investigated. It was found that the surface of such crystals has growth steps with a height of approximately 2000 Å. The tensile strength of the crystals depends on their cross section and attains values of 590 kg/mm^2, even for crystals exhibiting macroscopic growth steps. The growth mechanism of acicular crystals (needles) obtained from the vapor phase is discussed. Author

N65-23686*# National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF POROSITY ON THE MECHANICAL PROPERTIES OF METAL CERAMIC COPPER AND Cu-Al ALLOY [VLIYANIYE PORISTOSTI NA MEKHANICHESKIYE SVOYSTVA METALLOKERAMICHESKOY MEDI I SPLAVA Cu-Al]
A. P. Savitskiy, Yu. I. Kozlov, V. I. Itin, K. V. Savitskiy, and V. N. Zhdanova May 1965 8 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk), no. 5, 1964 p 34–37
(NASA-TT-F-9363) CFSTI: HC $1.00/MF $0.50

The hardness and compressive strength of copper and Cu–Al alloy prepared by powder metallurgical methods are investigated as a function by their porosity. It is shown that the mechanical properties depend linearly on the porosity in materials with a low pore density. Author

N65-23692*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECTS OF SEVERAL METAL AND COMPOUND ADDITIONS ON GRAIN GROWTH OF OXIDES
Alan Arias Washington, NASA, May 1965 16 p refs
(NASA-TN-D-2820) CFSTI: HC $1.00/MF $0.50

The effect of 10-vol% additions of chromium, molybdenum, tungsten, nickel, titanium, boron nitride, and zirconium diboride on the grain growth of alumina, hafnia, magnesia, and zirconia was investigated by vacuum-heat-treating specimens made from bars of the same material previously vacuum-hot-pressed at lower temperatures. These bars contained a layer of the pure oxide to allow comparison of grain-growth effects. A study of the grain size of the pure oxide layer adjacent to the oxide–metal composition led to the discovery of exaggerated grain growth of the pure oxide at the interface with some of the oxide–metal layers. The results of this investigation show that (1) most of the metals and compounds added inhibit the grain growth in varying degrees of the four oxides studied; (2) some metals and compounds enhance grain growth, which appears to be related to the effect of impurities from the addition; and (3) no correlation could be found between reactivity, melting point, and volatility of the metal addition and grain growth of the matrix oxide. The effect of each metal appears to be specific. Author

N65-23693*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECT OF THREE METAL ADDITIONS ON GRAIN SIZE OF MAGNESIUM OXIDE AFTER HIGH-TEMPERATURE HEAT TREATMENTS
Alan Arias Washington, NASA, May 1965 16 p refs
(NASA-TN-D-2823) CFSTI: HC $1.00/MF $0.50

The effects of additions of chromium, molybdenum, and tungsten on the grain growth of vacuum hot-pressed magnesium oxide were investigated. The effects of heat-treating temperature, time, and hydrogen cleaning of the specimens before hot-pressing were also investigated. The effects of tungsten, molybdenum, and chromium depend on the amount of addition, and, for tungsten, also on the heat-treating temperature. In general, beyond about 4 vol% addition, all three metals inhibit the grain growth of magnesium oxide at 1620° C. The effectiveness of these metals as grain-growth inhibitors for magnesium oxide at 1620° C decreases in the order chromium, molybdenum, tungsten. Magnesium oxide with chromium, molybdenum, and tungsten additions shows a decrease in rate

of grain growth. The effect of amount of tungsten addition on the temperature dependence of grain growth of magnesium oxide was as predicted by theory. It is surmised that the observed grain-growth dependence on composition, amount of addition, temperature, and time is due to the combined effects of dissolved impurities and the grain-growth-inhibiting properties of the metal additions that act as inclusions. Author

N65-23696*# General Dynamics/Convair, San Diego, Calif.
ONSET OF CREEP STRESS MEASUREMENT OF METALLIC MATERIALS Interim Report
C. W. Alesch 15 Apr. 1964 86 p
(Contract NASw-739)
(NASA-CR-62648; GDC-64-128) CFSTI: HC $3.00/MF $0.75

Tension test results are reported for the following materials: Ti-8Al-1Mo-1V, Ti-6Al-4V, Ti-5Al-2.5Sn, AM-350, AM-355, PH 15-7 Mo, PH 14-8 Mo, and 18% Ni maraging steel. Further, the average stresses required for 0.01% tensile strain; the modulii of elasticity used for the stress-strain diagrams; and the preliminary creep test results are reported. Also, charts are shown which indicate the trends observed in these tests. E.E.B.

N65-23708*# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
STRESS CORROSION CRACKING OF TITANIUM ALLOYS Progress Report, Apr. 1–Jun. 30, 1964
Sheldon P. Rideout, Mc Intyre R. Louthan, Jr., and Clifford L. Selby Aug. 1964 17 p refs
(NASA Order R-124; Contract AT(07-2)-1)
(NASA-CR-60194; DP(NASA)-917) CFSTI: HC $1.00/MF $0.50

Results of research work to determine the mechanism of hot-salt stress corrosion cracking of titanium alloys are given. Exploratory tests were started with radiotracer ^{36}Cl to determine the role of chloride in the corrosion cracking phenomenon. Direct observations were made of salt reaction with Ti-8Al-1Mo-1V alloy at various temperatures. Electron microscopy studies were started to determine the relationship between alloy structure and crack morphology. Preliminary results indicate that a small amount of HCl gas is given off during dehydration of sea salt heated to 650° F. The HCl gas and/or resultant hydroxides may be involved in initiation of stress corrosion cracking. Crack examinations revealed the following: cracks propagate along alpha phase grain boundaries and alpha-beta phase interfaces; they appear to propagate by chemical attack with no evidence of mechanical rupture. The beta phase is cathodic to the alpha matrix and is contained unattacked within corrosion products in stress corrosion cracks. Author

N65-23716*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF HYDROGEN ON THE MECHANICAL PROPERTIES OF TITANIUM AND OT4-1 ALLOY [VLIYANIYE VODORODA NA MEKHANICHESKIYE SVOYSTVA TITANA I SPLAVA OT4-1]
V. A. Livanov, A. A. Bukhanova, B. A. Kolachev, N. P. Neverova-Skobeleva, I. I. Slavina et al May 1965 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Tsvet. Met. (USSR), v. 7, no. 4, 1964 p 124–129
(NASA-TT-F-9365) CFSTI: HC $1.00/MF $0.50

Tests to determine the effect of hydrogen impurity on the mechanical properties of titanium and a low alloy of titanium are described. The property most affected by increased hydrogen content is the ductility, which increases the embrittlement and fracture tendency of these metals under dynamic loading. The situation is alleviated, however, by heat treatment at 900° C with quenching in air or water. It is found that existing Soviet norms for the maximum permissible ductility of the tested metals are not adequate to ensure passable ductility values. Nor is it certain, if the properties are improved by heat treatment, just how stable they will remain with aging. Further investigations are indicated. Author

N65-23735# European Atomic Energy Community, Brussels (Belgium).
CONTRIBUTION TO THE STUDY OF MOLTEN SAP [CONTRIBUTION A L'ETUDE DU SAP FONDU]
G. Beghi and G. Piatti 1964 62 p refs In FRENCH; ENGLISH summary
(EUR-2205.f) Available from Belgian Am. Bank and Trust Co., New York, Account No. 22.186: 85 Belg. Fr.

A study was initiated on the possibility of heating sintered aluminum up to the melting point of the matrix without causing a complete and irreversible destruction of its structure characterized by a fine dispersion on which its interesting properties, above all at hot temperatures, are based. Various thermal treatments, above the melting point of aluminum, followed by extrusion procedures were carried out on SAP with a nominal percentage of aluminium of 7%. The material obtained was studied by aid of different experimental techniques: metallography, electronic microscopy, X-ray, and mechanical tests. The results are in graphic form which from the quantitative viewpoint determines the temperatures and times of fusion which prevent any relatively important alterations in the structure of SAP itself. Author

N65-23757# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
HIGH-DENSITY ALLOYS FOR SHELL FRAGMENTS
Charles W. Semple Dec. 1964 18 p refs
(AMRA-TR-64-46; AD-461787)

High-density alloys of tungsten, tantalum, and uranium were fabricated into cubes. Mechanical (tensile, compression, hardness, impact), chemical, and metallographic tests and examinations were conducted on the materials. Author

N65-23763# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
PROPERTIES OF REFRACTORY AND ABLATIVE MATERIALS TO 5000° F
L. E. Cothran Nov. 1963 310 p refs
(SM-44549)

A collection of high temperature properties of various refractory and ablative materials exposed up to 5000° F is presented. Investigated were tensile strength, compressive strength, shear strength, flexural strength, modulus of rupture, elongation, compression, modulus of elasticity, thermal expansion, thermal conductivity, specific heat, and emittance. The melting points of the pure refractory materials are presented in tables. G.G.

N65-23835*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF GROWTH PARAMETERS FOR REFRACTORY CARBIDE SINGLE CRYSTALS Quarterly Status Report No. 4, Dec. 1, 1964–Mar. 1, 1965
F. A. Halden and W. E. Nelson 26 Apr. 1965 19 p refs
(Contract NASr-49)
(NASA-CR-62727) CFSTI: HC $1.00/MF $0.50

Several new techniques and procedures for the growth of single crystals of tantalum carbide, hafnium carbide, and solid

solutions of the two, investigation by X-ray lattice measurements, and examination of polished sections of arc-melted, high purity tantalum carbide boules are reported. The studies confirm that a single phase can be maintained during melting and that the stoichiometry can be varied by control of the gaseous environment. On the basis of these studies, the final arc-melting furnace has been designed and is now being constructed. Also, very small crystals of tantalum carbide have been grown in aluminum and iron alloys. R.C.S.

N65-23867# Societe d'Etudes, de Recherches et d'Applications pour l'Industrie, Brussels (Belgium).
INFLUENCE OF SURFACE TREATMENT ON THE CORROSION OF CARBON STEEL AND STAINLESS STEEL IN HIGH TEMPERATURE WATER AND STEAM. PART I: RESULTS OF AUTOCLAVE TESTS [INFLUENCE DU TRAITEMENT DE SURFACE SUR LA CORROSION D'ACIERS AU CARBONE ET INOXYDABLE DANS L'EAU ET LA VAPEUR A HAUTE TEMPERATURE. PARTIE I: RESULTATS DES ESSAIS EN AUTOCLAVE]
M. Warzee, J. Hennaut, M. Maurice, J. Waty, and Ph. Berge Brussels, EURATOM, 1964 37 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-089-62-7 RDB)
(EURAEC-1038; EUR-1735.f) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 40 Belg. Fr.

Austenitic 18-10 stainless steel with 0.04% carbon (AISI 304) and a low alloy boiler steel grade were basic materials. Four distinctly different states compared were mill-machined, ground, machine-polished up to grade 600, and electrolytically polished in an acetoperchloric solution. The influence of the surface state was investigated by static autoclave tests in water at 300° C and in steam at 400° C-200 kg/cm^2, during periods of 300, 1000 and 2000 hours. An influence, significant of the surface state, was revealed in all the examined cases. The major fact relative to this influence is its differentiated character according to the nature of the steel and the oxidation conditions. As concerns the low alloy steel, the surface state has a similar influence in water at 300°C and steam at 400°C. Electrolytic polishing allows lowering the corrosion rate by approximately a factor of two as compared to ground and machine polished states. Tests on an austenitic 18-10 stainless steel provide quite different conclusions. If the fact that electrolytic polishing leads to an important improvement in water at 300° C, it appears on the other hand that this surface treatment is baleful in steam at 400° C. Author

N65-23869# Battelle Memorial Inst., Geneva (Switzerland).
THE RELATION BETWEEN TWINNING AND BRITTLE FRACTURE IN IRON AND IRON ALLOYS [LA RELATION ENTRE LE MACLAGE ET LA RUPTURE FRAGILE DANS LE FER ET LES ALLIAGES DU FER]
E. Anderson and J. Spreadborough Brussels, Euratom, 1965 35 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-095-62-12 RDS)
(EURAEC-1195; EUR-2034.f) Available from Belg. Am. Bank and Trust Co., New York Account No. 22.186: 40 Belg. Fr.

Metallographic studies indicate that the twinning behavior of iron and iron alloys can be discussed under two headings: twinning in fine-grained specimens, and twinning in coarse-grained specimens which are brittle or which exhibit ductile cleavage. In the case of the fine-grained samples twins appear around 150° K in the largest grains, being formed at the front of a Lüders band. As the temperature is lowered the number of twinned grains increases. The twinning stress is more dependent on the grain size than the stress necessary for deformation by slip, so the twinning in fine-grained specimens is accounted for by a simple yield propagation model. In specimens of the second group, two types of twin are observed—deformed twins and fine twins formed by the passage of cracks. Since the oxygen content of the materials is high, and since the fractures of samples examined in the region of the ductile–brittle transition temperature were nearly always of the mixed inter-intracrystalline type, it is felt that all the observed brittle fractures are intercrystalline in origin. Author

N65-23879# Bureau of Mines, Albany, Ore. Albany Metallurgy Research Center
METALLURGICAL PROGRESS REPORT Quarterly Report No. 26, Jan. 1–Mar. 31, 1965
A. H. Roberson [1965] 27 p
(Contract AT(11-1)-599)
(USBM-RC-1158) CFSTI: $2.00

Hafnium carbide castings with total carbon contents ranging from about 8.5 to 11.5 wt% were tested for tensile properties at temperatures from 20° to 2180° C. Also, the modulus of elasticity were calculated for 20°, 1100°, and 1580° C. Values of 48, 30, and 14.5 × 10^6 psi were reported. The effect of organic binders on the carbon content, fabricability, and tensile properties of thorium alloys was also investigated. Although an increase from 0.1% to 0.6% C was observed, no significant changes in fabricability or tensile properties were noted. Efforts toward cold-mold induction melting centered on scaling up the equipment and renovating a surplus power unit. The investigation of the system UC–UN–UO was centered on improvement of techniques, sintering, composition control, and oxidation reduction. Further, the preparation of W–25Re alloys by powder metallurgy and the blending of rhenium and rhenium-base alloys were reported. E.E.B.

N65-23911# Pennsylvania Univ., Philadelphia. School of Metallurgical Engineering
MICROYIELD STUDY OF DISPERSION STRENGTHENING IN SPHEROIDIZED STEEL AT ROOM TEMPERATURE
R. Kossowsky (M.S. Thesis) and Norman Brown 7 Feb. 1964 37 p refs
(Contract Nonr-551(20))
(AD-431127)

Plain carbon steels with 0.48% and 0.95% C were quenched and tempered to 705° C to produce carbide dispersions with spacings on the order of 1μ. The morphology of the structure consisted of a carbide-dislocation network. The strengthening due to the dispersion was found to vary linearly with $M^{-1/2}$ where M is the mean free-ferrite path determined by the entire network. No preyield microstrain preceded the upper yield point. After prestraining, the lowest stress at which dislocation movement could be detected was 10^4 psi; this functional stress was independent of the dispersion and prestrains up to 6.5%. The Cottrell–Petch theory of grain size strengthening was found appropriate for understanding the dispersion strengthening. Results support an impurity mechanism for the drop in yield point rather than one based on the Johnston–Gilman theory. Author

N65-24010# Royal Aircraft Establishment, Farnborough (England).
FURTHER EXPERIMENTS ON THE ATMOSPHERIC STRESS-CORROSION OF ALUMINIUM ALLOYS
G. Meikle London, Min. of Aviation [1963] 45 p refs
(RAE-MET-PHYS-96)

Further experiments on atmospheric stress corrosion were made using material from large forged blocks, and the effects of heat treatment variations studied. The aluminum–zinc–magnesium type of alloy was shown to respond to heat treatment

variations when stressed in the long transverse direction but poor stress-corrosion results were obtained generally in the short transverse direction except with heat treatments that gave relatively poor tensile properties. The most satisfactory treatment to give good resistance to stress corrosion is one involving quenching from the solution temperature into molten salt at 180° C. The short transverse creep properties determined at room temperature were found to be worse than those in the long transverse direction. The aluminum–copper type of alloy was found to have good stress-corrosion properties, even in the short transverse direction. Author

N65-24086# Air Force Systems Command, Wright-Patterson AFB, Ohio. AF Materials Lab.
MECHANICAL CONSIDERATIONS IN THE UTILIZATION OF BERYLLIUM IN STRUCTURAL SYSTEMS. PART I: EQUATIONS FOR PLANE ELASTIC ANALYSIS OF A TRANSVERSELY ISOTROPIC MEDIUM Technical Report, Jun.–Sep. 1964
P. K. Dai Jan. 1965 22 p refs
(AFML-TR-64-395, Pt. I; AD-461344)

The elastic stress analysis of a transversely isotropic medium, such as a cross-rolled beryllium sheet, is considerably complicated by the fact that the description of the stress–strain relationship for such a medium in the elastic range requires five material constants. The plane elastic analyses for such a medium are considered. Equations for plane strain and plane stress conditions have been derived. It was found that in the plane of isotropy, the equation is biharmonic; hence the solution for the equation is expected to be the same as that for an isotropic medium, provided the boundary condition is such that only forces are prescribed at the boundary. In planes perpendicular to the plane of isotropy, the medium may be regarded as orthotropic, for which a quasi-biharmonic equation has been obtained. Author

N65-24093# Joint Publications Research Service, Washington, D. C.
PROPERTIES OF SOME NIOBIUM ALLOYS PRODUCED BY ELECTRON BEAM MELTING
I. S. Malashenko 17 May 1965 10 p refs Transl. into ENGLISH from Fiz. Khim. Mekhan. Materialov (Kiev), vol. 1, 1965 p 67–72
(JPRS-30100; TT-65-31002) CFSTI: $1.00

Effectiveness of alloying Nb with W, Mo, Zr and V is shown to increase according to the measure of complication of the alloy composition. In comparison with W, Mo worsens the plastic properties of Nb to a greater degree. The Nb alloys with 8% to 9% W possess satisfactory combinations of high temperature plasticity and strength at 1100° to 1200° C. The Zr and V together with W and Mo are necessary components for creating high-strength Nb alloys. To combine high-temperature strength and technical qualities in prospective Nb structural alloys it is necessary to conduct multicomponent alloying of the matrix under conditions which limit its contamination with harmful impurities. Author

N65-24116*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY RESULTS OF A COMPARATIVE STUDY OF SEVERAL COMMERCIALLY AVAILABLE OXIDATION RESISTANT COATINGS ON Mo-0.5 Ti ALLOY SHEET
D. R. Rummler, B. A. Stein, and R. A. Pride [1962] 16 p Presented at 6th meeting of the Refractory Composites Working Group, Dayton, Ohio, 16–19 Jun. 1962
(NASA-TM-X-56184) CFSTI: HC $1.00/MF $0.50

Data are presented for the results of oxidation tests in static air at 2500° F and include constant and cyclic temperature tests, tests on three edge conditions, and room temperature tensile tests on coated specimens. This program was concerned primarily with coatings for thin sheet structural applications above 2000° F. All specimens were fabricated from stress-relieved Mo–0.5Ti sheet 0.012 in. thick. It was found that thicker coatings generally gave longer lifetimes in both static and cyclic tests but had the most severe effect on the mechanical properties of the substrates. A failure criterion of about 6% weight loss appears reasonable for the specimens tested. Cyclic oxidation testing was more severe on all coatings tested than continuous static tests in terms of lifetime. Further, sheared edges and tumbled edges on the substrate before coating generally provided longer lifetimes than machined and broken edges. E.E.B.

N65-24117*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANELASTIC BEHAVIOR OF COPPER SINGLE CRYSTALS AT LOW STRESSES
C. A. Stearns, E. R. Gotsky, and J. P. Cusick 26 Mar. 1964 6 p refs
(NASA-TM-X-51670) CFSTI: HC $1.00/MF $0.50

Compressive stress–strain measurements in the premacroyield region were made on 99.999% pure copper single crystals compressed at a constant strain rate of 4.5×10^{-5} sec^{-1}. Cyclic loading–unloading curves for a single specimen show: (1) Both the loading and unloading curves are nonlinear with a concave upward curvature. (2) The first few cycles show open hysteresis loops. (3) After a number of cycles to loads equal to or less than the maximum of the first cycle, closed loops results. (4) A change in slope occurs when the load exceeds the maximum of previous cycles. (5) A nonuniform strain increment at the crosshead reversal in the first few cycles disappears with successive cycling. Stress–strain behavior of several ionic single crystals at low amplitude mechanical oscillations opened closed hysteresis loops. This strain increment is explained by coupling of the elastic energy stored in the loading system with the still active slip processes in the specimen, resulting in additional strain after the reversal of direction of the imposed strain. G.G.

N65-24215# Rock Island Arsenal Lab., Ill.
CONTROL OF STRESS CORROSION Second Interim Report
R. H. Wolff 18 Jan. 1965 15 p refs
(RIA-65-152; AD-613652) CFSTI: $0.50

This study of the control of stress corrosion cracking susceptibility of steels by application of protective coatings was designed to use abrasive blasted specimens to simulate more nearly the surfaces and conditions of a manufacturing operation. Bent beam specimens of 4130, 6150, and 18%-nickel maraging steel were prepared at yield strength levels of 204, 231, and 316 ksi, respectively, for test at 75% of yield strength. Test atmospheres were outdoor, high humidity and salt spray (5%), and cycles of these alternating between salt spray, humidity and air. Cycle tests produced more rapid failure than single environments. Abrasive blasting extended the time to failure as compared to nonblasted uncoated specimens. Coated specimens were electroplated with zinc, zinc phosphatized, or brushed with zinc-filled paint. Specimens of 4130 steel had not failed in over a year in outdoor exposure and 6 months in high humidity. Failures were noted with all the materials in cycle tests with indication of extended time to failure as a result of using zinc-filled paint. Author

N65-24218# Northwestern Univ., Evanston, Ill. Dept. of Materials Science
THE SUBSTRUCTURE OF Cu_3Au AFTER TENSILE DEFORMATION AND SHOCK LOADING
D. E. Mikkola and J. B. Cohen 15 Mar. 1965 57 p refs
(Contract Nonr-1228(20))
(TR-5; AD-614692)

A recent investigation showed a sharp rise in resistivity and stored energy in the range 290–370 kb on shock-loading initially ordered Cu_3Au, but not with the initially disordered alloy. Using samples from that investigation, optical and transmission microscopy and X-ray diffraction were employed to study the substructure. Specimens were also deformed in ordinary tension at 77° and 298° K for comparison. There was no sudden increase in the dislocation densities or marked change in dislocation arrangement in the shock-loaded specimens corresponding to the rise in energy and resistivity. Local order was reduced by shock loading the initially disordered specimens. There was local order among the atoms misplaced by deformation in the initially ordered specimens. The interplanar spacing decreased at {001} antiphase boundaries, but increased at {111} boundaries. This indicates that the second-neighbor energy has the same sign as the first in this system. Author

N65-24285# Siemens-Schuckertwerke A. G., Erlangen (West Germany).
RESEARCH ON ZIRCONIUM HYDRIDE IN ZIRCALOY-2 AND ZrNb ALLOYS [UNTERSUCHUNGEN UBER ZIRKONHYDRID IN ZIRCALOY-2 UND ZrNb-LEGIERUNGEN]
Brussels, EURATOM, Feb. 1965 43 p In GERMAN; ENGLISH summary
(Contract EURATOM-024-61-10 RDA)
(EURAEC-1161; EUR-2013.d) Available from Belg. Am. Bank and Trust Co., N. Y., Account No. 22.186: 60 Belg. Fr.

Test bars of alloys of Zircaloy-2, ZrNb1, ZrNb2.5, ZrNb1Cu1 and ZrCu0.5Mo0.5 were prepared by vacuum melting, electron beam melting or argon melting and tested in different states: 25% cold-worked, annealed in α-phase and annealed in β-phase with slow cooling. The corrosion tests were carried out in water vapor at 500° C, 1 atm and in water under pressure at 350° C, 168 atm. Measurements were carried out to determine the corrosion speed and the relative and absolute hydrogen pickup in these alloys. A comparative micrographic study was conducted on the oxide film and the structure of the hydrides formed both on the samples corroded in water and steam and on those artificially charged with hydrogen up to contents of around 2000 ppm. The influence of the hydrogen content on the mechanical properties was determined in the case of the artificially charged samples. The results confirm the satisfactory behavior of Zircaloy-2 in water at 350° C and the superiority of ZrNb alloys and particularly ZrNb2.5 and ZrCu0.5Mo0.5 in steam at 500° C. Author

N65-24327# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
HIGH-STRENGTH STEELS Review of Recent Developments
D. A. Roberts 14 May 1965 3 p refs

Results of independent studies on the kinetics and mechanisms of strengthening maraging steels are reported. The development of high strength steels utilizing the following techniques is reviewed: strain tempering and ausforming, stress aging, high pressure shock waves, rapid heat treatment, thermal mechanical working, consumable-electrode vacuum melting, and consumable-electrode vacuum arc remelting. S.C.W.

N65-24329# Mechanical Properties Data Center, Suttons Bay, Mich.
AISI H-13-HOT WORK DIE STEEL Inventory Report 620
Aug. 1964 9 p refs
(AD-610333)

A summary inventory of the mechanical properties of AISI H-13 hot-work-die steel in the retrieval system is presented to acquaint the aerospace industries with the information content and use of the Mechanical Properties Data Center. R.C.S.

N65-24344# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center
POWER METALLURGY Review of Recent Developments
D. E. Lozier and D. E. Kizer 7 May 1965 3 p refs

Results of independent powder metallurgical research focusing on the development of improved sintering, compaction, and plasma spraying techniques, are reported. Data on the effects of isothermal and vacuum sintering on grain growth kinetics of nickel, tungsten, iridium, ruthenium, and thorium, are presented. A new compacting technique for green pressing shear fracture-free pellets of tungsten microspheres in a conventional cylindrical steel die, utilizing a silicone rubber mold insert formed with several barrel shaped chambers, is reported. This technique allows variations in size and shape of pellets, use of a conventional hydraulic press and die equipment, and a means of green pressing powders previously difficult to bond using a conventional steel die. A technique for preventing electrode compacts of tantalum from warping and causing extensive crucible damage during melting is also discussed. A study of the bonding mechanism between plasma sprayed tungsten powder and stainless steel substrates is reviewed. S.C.W.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N65-23726# Southern Research Inst., Birmingham, Ala.
THE DEVELOPMENT AND EVALUATION OF HEAT-RESISTANT, RAIN-EROSION RESISTANT COATINGS Bimonthly Progress Report, 26 Oct.–26 Dec. 1963
A. B. Perkins 23 Jan. 1964 18 p
(Contract N156-43450)
(BMPR-3; AD-429498)

Viton A was selected as the most promising of the polymers for use in heat- and rain-erosion-resistant coatings. Studies of methods of filler dispersion, curing and heat-stabilizing agents, and primers were made to develop the optimum formulations for Viton A coatings. The abrasion resistance of coatings made from compositions prepared by dispersing fillers and acid acceptors into a solution of the polymer by bead-mill grinding was slightly higher than that of coatings made from identical formulations compounded by dispersing the fillers and acid acceptors into the polymer and then preparing the solutions. Coatings made from compositions with magnesium oxide as the acid acceptor were slightly superior in abrasion resistance to coatings made from comparable compositions containing a mixture of zinc oxide and Dyphos as

the acid acceptor. A primer system for aluminum that appears to be suitable for service at 600° F was developed. It consists of a base coat of phenoxy wash primer applied directly to the aluminum substrate and a light wash coat of diphenylmethane diisocyanate that is sprayed on just prior to top coating. Author

N65-23840 Library of Congress, Washington, D. C. Aerospace Technology Div.
MORPHOLOGICAL FORMS IN HIGH POLYMERS
Boris Ofrossimow *In its* Foreign Sci. Bull. Apr. 1965 p 29–40 refs (See N65-23836 13-34) CFSTI: HC $3.00/MF $0.75

Recent Soviet studies on formation, deformation, and breakdown of morphological forms in high polymers, on methods for controlling these forms, and on the effect of morphological forms on the properties of high polymers are reviewed. Most of these studies were conducted by scientists who consider that all of the mechanical properties and some other macroscopic properties of high polymers are determined at the level of morphological forms and that tailormade polymeric materials with predetermined properties could be prepared by controlling the morphological forms in high polymers. Author

N65-24292*# Alabama Univ. Research Inst., Huntsville.
THE RELATIONSHIP BETWEEN THE VISCOSITY AND THE DC-CONDUCTIVITY IN POLYVINYLCHLORIDE
Juerg-Heinrich Kallweit Mar. 1965 24 p refs
(Grant NsG-381)
(NASA-CR-62799; UARI-RR-20) CFSTI: HC $1.00/MF $0.50

It is common assumption that the dc-conductivity σ in high polymers mainly depends on the sample viscosity η because both the viscosity and conductivity show a similar strong temperature dependence. In accordance with Walden's rule, it is written $\sigma \sim 1/\eta$. To check this relation, the same samples of polyvinylchloride with varied plasticizer content (palatinol AH = dioctylphthalate) were used to measure the viscosity and dc conductivity as functions of time and temperature. Author

N65-24369# Wyandotte Chemicals Corp., Mich. Polymer Research Dept.
SYNTHESIS OF LOW TEMPERATURE OIL RESISTANT URETHANE ELASTOMERS Quarterly Progress Report, 1 Dec. 1964–28 Feb. 1965
S. L. Axelrood and W. J. Lajiness 28 Feb. 1965 22 p
(Contract DA-20-018-ORD-24883)
(QPR-8; AD-613360)

Pagination No. PR1665-0, containing a 14000-molecular weight polyether triol, polytetramethylene ether glycol (2860 M.W.), trimethylol propane, dichlorobenzidine (DCB) and tolylene diisocyanate (TDI), was selected as a standard formulation. Variations were made in cure, catalyst, and excess TDI. Samples were also made substituting PLURACOL TP-340 for trimethylol propane, 2,6, dichloro-*p*-phenylene diamine and 2,3 dichloro-anthraquinone for DCB, bitolylene diisocyanate (TODI) for TDI, and a polytrimethylene oxide glycol (1450 M.W.) for the polytetramethylene oxide glycol. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N65-23369 Joint Publications Research Service, Washington, D. C.
HARMONIC ANALYSIS OF UNITARY GROUPS
Lo-Keng Hua *In its* Transl. on Communist China's Sci. and Tech. 21 Apr. 1965 p 1–22 refs Transl. into ENGLISH from K'o-hsueh T'ung Pao (Peking), no. 3, 17 Mar. 1965 (See N65-23368 13-34) CFSTI: $2.00

Some summation principles concerning n dimensional unitary group U_n and its Fourier series coefficient are discussed, and the approximation principle of any bounded compact group, and on any compact space was obtained. The Poisson formula in the classical region of n dimensional matrices was used to obtain the Fourier series and the Abel summation principle on U_n. Discussed is also the generalization of the Dirichlet kernel and the Fejér kernel. G.G.

N65-23661*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
A NEW ALGORITHM FOR QUADRATURE
Gunter G. Weber 26 Mar. 1965 20 p refs
(Grant NsG-275-62)
(NASA-CR-62662; WIS-TCI-79) CFSTI: HC $1.00/MF $0.50

A new algorithm for interpolation, inverse interpolation, and integration of functions given by a table is proposed, and numerical examples are given. Author

N65-23664# Stanford Research Inst., Menlo Park, Calif.
SOME ELEMENTARY PRINCIPLES OF HYPOTHESIS TESTING
M. Gorfinkel and G. L. Sutherland Feb. 1965 29 p refs
(Contract ARPA SD-103; ARPA Order 281-62)
(Rept.-11; AD-458646)

In standard statistical terminology, some of the basic ideas concerning the testing of statistical hypotheses are presented. In particular, this report covers data which has been generated by a radar device observing a vehicle reentering the earth's atmosphere. Author

N65-23676*# National Aeronautics and Space Administration, Washington, D. C.
THE RAYLEIGH–RITZ METHOD WITH HERMITIAN INTERPOLATION POLYNOMIALS [DAS VERFAHREN VON RAYLEIGH–RITZ MIT HERMITESCHEN INTERPOLATIONSPOLYNOMEN]
S. Falk May 1965 33 p refs Transl. into ENGLISH from Z. Angew. Math. Mech. (Berlin), v. 43, no. 4/5, 1963 p 149–166
(NASA-TT-F-9334) CFSTI: HC $2.00/MF $0.50

Hermitian interpolation polynomials are applied to the development of admissible or comparison functions for the Ritz method, for simplification of the calculation of elastically supported beams, harmonically vibrating at constant pressure (two-parameter eigenvalue problem). For differential equations with constant coefficients, ready-made integration matrices are given such that the entire method is reduced to a mere multiplication of matrices and consequently readily programed on digital computers. Author

N65-23760# New York Univ., N. Y. Div. of Electromagnetic Research
ASYMPTOTIC METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS: THE REDUCED WAVE EQUATION AND MAXWELL'S EQUATION
Robert M. Lewis and Joseph B. Keller Jan. 1964 142 p refs
(Contract AF 19(604)-5238)
(EM-194; AFCRL-63-551; AD-430681)

The asymptotic theory of the reduced wave equation and Maxwell's equations for high frequencies is presented. The

theory is applied to representative problems involving reflection, transmission, and diffraction in homogeneous and inhomogeneous media. This report contains few new results. The existing literature on the subject is unified and summarized. Author

N65-23783* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A MATHEMATICAL METHOD TO DETERMINE THE ATTITUDE OF A SPHERE
Hans F. Kennel *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 9–19 (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

A method for determining the attitude of a sphere without restricting its angular freedom is presented. Only the mathematical aspect of the problem is treated. Neither implementation nor accuracy of performance is discussed. The method has an application in spacecraft attitude simulators supported on spherical gas bearings. The sphere is marked with three mutually perpendicular great circles and intersected in a minor circle by a stationary plane. The intersections of the great circles with the minor circle define the attitude of the sphere relative to the plane. The orthogonal transformation matrix is developed, which allows the calculation of the Euler angles of any desired sequence. Author

N65-23829*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.
AN APPLICATION OF GENERALIZED MATRIX INVERSION TO SEQUENTIAL LEAST SQUARES PARAMETER ESTIMATION
Henry P. Decell, Jr. May 1965 15 p refs
(NASA-TN-D-2830) CFSTI: HC $1.00/MF $0.50

This algorithm allows the parameter estimation to begin after the first observation is made and affords a means of computing the n*th* parameter state from the (n-1)st parameter state and the n*th* observation. Problems associated with singular matrices encountered in iterative least squares procedures do not affect the algorithm. Author

N65-23944# Navy Electronics Lab., San Diego, Calif.
STATISTICAL MEAN-SQUARED ERROR OPTIMIZATION OF LINEAR, TIME-INVARIANT, CONTINUOUS SYSTEMS
D. H. Lackowski 9 Nov. 1964 78 p refs
(NEL-1251; AD-455772)

A report on the optimum design of a large class of systems is presented. The design criterion is chosen to be the mean squared value of some specified system signal. The investigation is restricted to continuous systems that are linear and time invariant, and which have inputs that can be statistically described. Data are organized into four parts. Part I presents the elements of probability theory essential to the statistical design of systems. Part II presents the essential details of three pertinent methods of analysis which are time domain, frequency domain, and complex frequency domain. Data presented in Parts I and II are combined in Part III and applied to the analysis of linear, time invariant, continuous systems whose inputs can be statistically described by correlation functions. The specific problem considered is that of determining the statistical properties of a system output, given the system weighting function and a statistical description in terms of correlation functions, of the system inputs. In Part IV, statistical mean square error optimization of linear, time invariant, continuous systems is developed. Examples are included which show the design of an optimum predictor, an optimum filter, and the design of an optimum filter constrained by fixed elements. S.C.W.

N65-23951# European Space Vehicle Launcher Development Organization, Paris (France).
EVALUATION OF THE STARTING VELOCITY OF A DISCRETE REPETITION OF POSITION VALUES [EVALUATION DE LA VITESSE A PARTIR D'UNE SUCCESSION DISCRETE DE VALEURS DE POSITION]
E. Cambi Aug. 1964 13 p In FRENCH
(ELDO-TM-F-3)

The optimal formula for evaluating the derivative of a variable known by experimental verification is deduced, and the resulting performance is discussed. After developing numerical examples, it is concluded that it is opportune to make the information more reliable in order to carry out the smoothing of white noise and to bring the error to as low a degree as possible. Transl. by M.P.G.

N65-24055*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
ESTIMATION IN MIXTURES OF POISSON AND MIXTURES OF EXPONENTIAL DISTRIBUTIONS
A. Clifford Cohen, Jr. (Georgia Univ.) 19 Apr. 1965 26 p refs Research Performed by Georgia Univ. under contract NAS8-11175
(Contract NAS8-11175)
(NASA-TM-X-53245) CFSTI: HC $2.00/MF $0.50

An analysis of estimating equations for calculating the parameters of a compound (mixed) Poisson distribution with probability density function

$$f(x) = \alpha \frac{e^{-\mu}\mu^x}{x!} + (1-\alpha)\frac{e^{-\lambda}\lambda^x}{x!}, x = 0,1,2,\ldots$$

and the parameters of a compound exponential distribution with probability density function

$$f(x) = \alpha(1/\mu)e^{-x/\mu} + (1-\alpha)(1/\lambda)e^{-x/\lambda}, x \geq 0$$

is presented. Special cases are considered in which one or more of the parameters is known in advance of sampling. Results of a Fortran IV computer program analysis are included. S.C.W.

N65-24071# European Atomic Energy Community, Brussels (Belgium).
PRACTICAL STATISTIC AND SUBJECTIVISM [PRAKTISCHE STATISTIK UND SUBJEKTIVISMUS]
P. Ihm Jan. 1945 18 p refs In GERMAN; ENGLISH summary
(EUR-2224.d) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 40 Belg. Fr.

It is shown how confidence regions which generally are based on objectivistic probability can be interpreted in a subjectivistic sense. A particular case is discussed in which confidence regions are quantiles of likelihood functions or, under certain assumptions, of subjective probability distributions; possible generalizations are recorded. The P-value is also interpreted in the subjectivistic way. Author

N65-24139* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ESTIMATION IN MIXTURES OF TWO POISSON DISTRIBUTIONS
A. Clifford Cohen, Jr. (Georgia Univ.) *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 104–107 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

Techniques to resolve a mixture of two sample distributions into their respective components have applications in the statistical analysis of atmospheric data. Dealt with is the

estimation of parameters of a mixed distribution consisting of two Poisson components. Estimators based on the first three sample moments and on the first two sample moments plus the sample zero-frequency are considered. A computing routine is outlined for solving the estimating equations involved in the latter case. Author

N65-24242# Union Carbide Nuclear Co., Oak Ridge, Tenn.
BIASES AND COVARIANCES OF MAXIMUM LIKELIHOOD ESTIMATORS
K. O. Bowman and L. R. Shenton 19 May 1965 26 p refs
(Contract W-7405-ENG-26)
(K-1633) CFSTI: $2.00

A population is considered consisting of a denumerable set of classes, the probability of an occurrence in the $j\,th$ class being $P_j(O_1, O_2, \ldots O_k)$. For the maximum likelihood estimates $(\hat{O}_1, \hat{O}_2, \ldots \hat{O}_k)$ of the parameters $(O_1, O_2, \ldots O_k)$ in a random sample of a size N the N^{-2} terms are given in the asymptotic expansions of the variances and covariances in terms of expectations of products of derivatives of $\log p_j$. As an application the estimation of the parameter λ and α for a negative binomial distribution (mean λ and variance $\lambda + \lambda^2/\alpha$) is considered. This includes the second-order terms in Var $\hat{\alpha}$ and $E\hat{\alpha}$, and the first order correction term in the generalized efficiency of the method of moments. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N65-23439# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS FROM METEOROLOGIYA I GIDROLOGIYA (METEOROLOGY AND HYDROLOGY), NO. 2, 1965
7 Apr. 1965 48 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 2, 1965 p 3–12, 20–24, 38–52 (JPRS-29481; TT-65-30674) CFSTI: $2.00

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N65-23440 Joint Publications Research Service, Washington, D. C.
EXPERIENCE GAINED IN OPERATIONAL NUMERICAL FORECASTS OF CONTINUOUS PRECIPITATION
B. D. Uspenskiy *In its* Transl. from Meteorol. i Gidrol. (Meteorology and Hydrol.), No. 2, 1965 7 Apr. 1965 p 1–12 refs (See N65-23439 13-20) CFSTI: $2.00

The relationship between heat flow and moisture transfer equations, and the graphical curves for condensation level, thickness of the condensation layer, and for the dewpoint at its lower boundary are employed as the theoretical basis for a numerical method of forecasting continuous precipitation. Operational construction of numerical precipitation predictions for 40 to 50 geographical points with application of the above developed method showed a validity of 76%. G.G.

N65-23441 Joint Publications Research Service, Washington, D. C.
POSITION OF THE ISOPAUSE IN STRATOSPHERIC CYCLONES AND ANTICYCLONES AND THE CONNECTION OF ITS HEIGHT WITH THE VERTICAL DISTRIBUTION OF OZONE
L. A. Uranova *In its* Transl. from Meteorol. i Gidrol. (Meteorology and Hydrol.), No. 2, 1965 7 Apr. 1965 p 13–19 refs (See N65-23439 13-20) CFSTI: $2.00

The position of the isopause in stratospheric cyclones and anticyclones in the regions of the North Atlantic Ocean, Canada, and Alaska was studied during various seasons. Direct sounding data and baric topographic charts were used to construct spatial vertical temperature sections through the centers of cyclones and anticyclones, and an analysis of the data is presented in table form. It was concluded that the temperature level of the isopause is always lower in the cyclone than in the anticyclone, with the maximum difference of 25° to 28° occurring in January. The position of the isopause in the stratospheric anticyclones was much higher than in the cyclones during winter and spring, but reached the lowest level in both cases in January. A comparison of the height of the isopause and of the ozone layer in the atmosphere showed a dependence on the variation in the height of the ozone layer having a maximal amount of ozone. It was concluded that the cause for the isopause is a layer of maximal quantity of ozone at heights of 20 to 25 km. G.G.

N65-23442 Joint Publications Research Service, Washington, D. C.
USE OF METEOROLOGICAL INFORMATION AND FORECASTS IN PROVIDING RECOMMENDED COURSES TO SHIPS
K. P. Vasil'yev *In its* Transl. from Meteorol. i Gidrol. (Meteorology and Hydrol.), No. 2, 1965 7 Apr. 1965 p 20–23 (See N65-23439 13-20) CFSTI: $2.00

Hydrometeorological information needed for planning ship routes includes the knowledge of actual hydrometeorological conditions and the forecasting of its changes for the period of the trip. The basic factors that determine the weather conditions and the state of the sea along the route are (1) the baric conditions which the voyage will encounter and the corresponding weather conditions; and (2) the atmospheric fronts which will cross the cruise route and the likely weather conditions in the frontal zones. Particular attention must be paid to the sea state, the ice conditions, and the visibility along the cruise route. It was concluded that an optimal course computed from hydrometeorological conditions and navigational considerations will yield the most favorable cruising conditions. G.G.

N65-23778# Joint Publications Research Service, Washington, D. C.
NUMERICAL SOLUTION OF TIDE HYDRODYNAMIC EQUATIONS BY MEANS OF BESM-2 ELECTRONIC COMPUTER FOR THE PACIFIC AREA
K. T. Bogdanov, K. V. Kim, and V. A. Magarik 11 May 1965 34 p refs Transl. into ENGLISH from Tr. Inst. Okeanol. (Moscow), v. 75, 1964 p 73–98
(JPRS-30011; TT-65-30959) CFSTI: $2.00

New tidal maps of the four main component waves of the tide for the Pacific Ocean area are presented. The accuracy of the new tidal maps is sufficiently high and they are recommended for practical precomputations of the heights of tides in any point of the ocean where there are no reliably determined harmonic tide constants. Further, it was demonstrated that the cotidal maps of the Pacific Ocean plotted by the method of structure contours are almost identical with tidal maps plotted by calculations. The questions of setting up and solution of boundary value problems of various types were also investigated. E.E.B.

N65-23779# Joint Publications Research Service, Washington, D. C.
ON THE DETERMINATION OF THE BOUNDARIES OF CLOUD COVER
I. A. Kibel' 11 May 1965 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Ser. Mat., Fiz. (Moscow), v. 160, no. 4, 28 Oct. 1964 p 815–818
(JPRS-30021; TT-65-30966) CFSTI: $1.00

The hydrodynamic theory of cloud cover, originating on the leeward side of a mountain range, is discussed. The system of equations of hydrodynamics considers an adiabatic flow, in which there are scattered individual regions with pseudo-adiabatic flow; the boundaries of these regions are determined in parallel with the solution of the problem of the motion of the cloud cover. E.E.B.

N65-23832# Naval Ordnance Test Station, China Lake, Calif. Test Dept.
THE WEATHER AT NOTS, 1946–1963
D. L. Farnham and I. C. Vercy Nov. 1964 63 p refs Supersedes NAVORD-6527
(NAVWEPS-8639; NAVORD-6527; AD-456700)

This report summarizes surface and upper air climatological data at the U. S. Naval Ordnance Test Station, China Lake, California, from 1946 through 1963. Author

N65-23908# Department of Transport, Ottawa (Ontario). Meteorological Branch
HEAVY SNOWFALLS AT EDMONTON
G. C. Kozub 24 Jul. 1964 45 p refs
(CIR-4076; TEC-526; AD-456678)

Synoptic conditions favorable to the production of heavy snowfalls are discussed. Heavy snowstorms are classified into types, and corresponding examples given. An analysis is made of the vertical velocity at 600 mb during the heavy snowstorms. Author

N65-23982* Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography
TRANSPORT AND MIXING IN ATMOSPHERE
A. Wiin-Nielsen *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 11–24 refs (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Density of standard meteorological data is described and discussed. It is noted that the standard data have limited use for micrometeorological purposes, and that empirical turbulence and mixing theories must be employed to describe natural phenomena. Advantages and disadvantages of classical mixing length theory are discussed, and it is pointed out that it is an assumption that the flux of any quantity is directed opposite to the gradient of the quantity. Examples of momentums and heat transports in the atmosphere giving a transport in the opposite direction are shown. Standard meteorological data can be used to compute transports of momentum, sensible heat, and moisture in the atmosphere. Examples of such calculations are shown. The transports are given as functions of latitude, pressure, and longitudinal wave number. The maximum heat and moisture transports are in lower part of atmosphere, while the maximum momentum transport takes place in upper part of troposphere. It is demonstrated that a large fraction of the different transports is carried out by the largest scales of motion (the lowest wave numbers), especially during winter season. Author

N65-23983* Pennsylvania State Univ., University Park.
EXTRUSION OF STRATOSPHERIC AIR INTO TROPOSPHERE
E. F. Danielsen *In* Minnesota Univ., Minneapolis Proc. of the Atmospheric Biol. Conf. [1965] p 25–36 (See N65-23980 13-04) CFSTI: HC $6.00/MF $1.50

Contaminants that have a negligible settling rate are transported by the mean flow and diffused by the small-scale eddies (turbulent deviations from the mean) after they are injected into the atmosphere. The diffusion is not symmetrical because the diffusion coefficients vary with direction and because the concentration gradients are changed by the mean flow. The latter effect, often overlooked or underestimated in diffusion studies, can be demonstrated by three-dimensional trajectory analyses and radioactivity observations. Effect is important when mass is transported from stratosphere to troposphere, and it is also important when contaminants are injected into and transported in the troposphere. Author

N65-24081# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Environmental Sciences Directorate
GUSTY SURFACE WINDS, WHITE SANDS MISSILE RANGE: A STATISTICAL FORECAST AID
Marjorie Mc Lardie Hoidale Ft. Monmouth, N. J., Army Electron. Command, Apr. 1965 19 p
(ERDA-308; AD-462103)

A statistical forecast aid for determining the time, direction, and speed of the peak gust of the surface wind at White Sands Missile Range is presented. Author

N65-24123# Army Missile Command, Huntsville, Ala. Physical Science Lab.
A STUDY OF RAINDROP SIZE DISTRIBUTIONS AND PROBABILITY OF OCCURRENCE
Novella S. Billions 18 Jan. 1965 32 p refs
(RR-TR-65-1; AD-461661)

This report contains information on raindrop distributions and the probability of occurrence of various raindrop diameters. Representative values are given for raindrops in terms of different rain types. The primary purpose is to present data on rain droplets applicable to the Kwajalein Test Site. No droplet data exist for Kwajalein, but the method of analysis permits utilization of data from other stations. Author

N65-24182# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS FROM METEOROLIGIYA I GIDROLOGIYA (METEOROLOGY AND HYDROLOGY), NO. 3, 1965
19 Apr. 1965 54 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 3, 1965 p 36–41, 44–45, 49–60 (JPRS-29651; TT-65-30764) CFSTI: $3.00

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9. NEWS FROM THE INSTITUTIONS OF THE HYDROMETEOROLOGICAL SERVICE p 35–37

10. SOVIET LITERATURE ON METEOROLOGY AND HYDROLOGY FOR 1964 p 38–50

N65-24183 Joint Publications Research Service, Washington, D. C.
METHODS OF LONG-RANGE WEATHER FORECASTS
A. A. Rozhdestvenskiy *In its* Transl. from Meteorol. i Gidrol. (Meteorology and Hydrology), No. 3, 1965 19 Apr. 1965 p 27–30 refs (See N65-24182) CFSTI: $3.00

The creation of a unified classification of macrosynoptic processes of the Northern Hemisphere by the development of a total complex of parameters is discussed. A forecasting method should be developed on the basis of the science of weather and climate and should be improved by gradually taking into account a wide range of weather phenomena. This will increase the length of time for which the weather forecasts are made. Long-range weather forecasts and the development of a unified science of weather and climate depend on incorporating ideas from the field of long-range and short-range weather forecasts, as well as considerations of hydrodynamic analysis and the heat balance theory. G.G.

N65-24357*# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.
AEROBEE NASA 4.49 GS (S/N NASA 128-3) (12 APRIL 1965)
Marjorie Mc Lardie Hoidale May 1965 34 p refs
(NASA-CR-62874; ERDA-309) CFSTI: HC $2.00/MF $0.50

Meteorological data gathered for the launching of Aerobee NASA 4.49 GS (S/N NASA 128-3) are presented for ballistic studies; and appear along with calculated ballistic data. Author

N65-24358*# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.
AEROBEE NASA 127 UA (S/N AF 142) (15 APRIL 1965) Meteorological Data Report
Marjorie Mc Lardie Hoidale May 1965 41 p refs
(NASA-CR-62875; ERDA-310) CFSTI: HC $2.00/MF $0.50

Meteorological data gathered for the launching of Aerobee NASA 127 UA (S/N AF 142) are presented for ballistic studies, and appear along with calculated ballistic data. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N65-23642# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
APPLICATION OF INERTIAL LOCATOR CONCEPTS TO FAA BASIC FLIGHT INSPECTION, VOLUME I Final Report
Robert L. Hall, John Hatfield et al Jan. 1965 121 p refs
(Contract FA-64-WA-5139)
(R-483; RD-65-9)

Feasibility studies were made of utilizing an airborne inertial navigation system (inertial locator equipment) to provide aircraft position information to the basic flight inspection system. Design objectives were established for the flight inspection of VOR, VORTAC, and TACAN stations and Instrument Landing Systems (ILS). Analyses were made, including simulated computer flights, of the capabilities of inertial equipment to perform in the flight inspection missions. Conclusions, based on assumed inertial system performance, indicate that the use of inertial locator equipment is feasible, using updating techniques for some missions. Author

N65-23948# A.T.S. Co., Ltd., London (England).
MISSILE GUIDANCE AND CONTROL APPLICATIONS AND PRODUCTION
Nov. 1961 31 p
(Rept.-9/61)

A description of guidance and control techniques and a discussion of their applicability to several missiles are presented. Data are presented on the applicability of gyroscopes; inflight guidance system components such as the sensor unit and the discriminator and computer unit; conventional aerodynamic control surfaces and gimballed powerplants for regulating course control or alterations of the missile flight path; subdivisions of guidance systems such as preset guidance, command guidance, direction along a path, and homing; equipment which operates at certain phases of the missile flight as the initial or launch phase, midcourse guidance phase, and the terminal phase; and the general methods of guidance including wire guidance, radio command, beam riding, radar command, active homing, semiactive homing, passive homing, map matching, celestial guidance, and inertial guidance. Recent forecasts on the missile guidance industry in the United States, along with a short list of Western European firms concerned with missile guidance are included in this report. Guidance and control cost data are also included. S.C.W.

N65-23956# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
PRELIMINARY NOTE ON THE DETERMINATION OF THE POWER SPECTRUM OF SOME BUFFET PRESSURES
[1964] 17 p
(FF-16)

The power spectra were determined for selected buffet pressures. Between the power spectrum and the RMS-value of the buffet pressures the following relation exists:

$$\int_0^\infty \phi df = (\Delta c_p)^2 q^2.$$

During these tests and analyses an effective bandwidth from 2 to 600 cps was used so the relation reduced to:

$$\int_2^{600} \phi df = (\Delta c_p)^2 q^2.$$

where ϕ is the power spectral density of buffet pressures, q is the free-stream dynamic pressure, f is the frequency, and (Δc_p) is the RMS value. The pressure recordings were analyzed by feeding them to a band-pass filter with variable frequency. The value of ϕ was reported for 9 different frequencies and the boundary values of ϕ were determined by extrapolation at f = 2 and f = 600 cps. E.E.B.

N65-24014*# Northrop Space Labs., Huntsville, Ala. Space Systems Section
APOLLO EXTENSION SYSTEM STUDIES. NAVIGATION SYSTEM FOR A MOBILE LABORATORY
Doyle Thomas Huntsville, Ala., NASA. Marshall Space Flight Center, Mar. 1965 74 p refs
(Contract NAS8-11096)
(NASA-CR-61047) CFSTI: HC $3.00/MF $0.75

A typical dead reckoning system utilizing a vehicle attitude and heading reference package is studied. The distance information is resolved into coordinate axes which yield vehicle position. System error models are developed which provide equations for position error versus time and distance. Constant velocity operation is assumed in the analysis, however the error equations may be developed for any velocity profile where vehicle velocity is expressed as a function of time. A linear, single degree of freedom vertical loop, and a free directional gyro reference are the principal items studied in the error analysis. Component errors and vehicle disturbances are described and their effect is presented in a mathematical relationship. An error analysis, where typical vehicle parameters are assumed, is shown, with results presented for both rotational errors of the coordinate system and for resultant position errors. Author

N65-24050# Societé Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).
STATIONARY RELAY SATELLITE (24 HOUR) WITH ELECTRIC PROPULSION—STUDY OF THE PILOTAGE AND GUIDANCE [SATELLITE-RELAIS STATIONNAIRE (24 H.) A PROPULSION ELECTRIQUE—ETUDE DU PILOTAGE ET DU GUIDAGE]
6 Sep. 1962 54 p In FRENCH

Navigational theory of 24-hour satellites, comparisons of control by ejectors and inertia wheels, and the influence of perturbations on the orbit of a 24-hour satellite are discussed. The first study considers the bases of navigational theory for orbital transfer in the form of a spiral in the equatorial plane and for maintenance of a 24-hour orbit. The choice of trihedrons of reference, equations of motion for stabilization about the center of gravity, and movement of the center of gravity during orbital transfer and orbit maintenance are discussed. The second study concludes that inertia wheels are necessary to the precision required to maintain a 24-hour orbit, but that ejectors are required to establish the initial orientation. The use of both systems independently of each other is recommended. The third study concludes that the greatest causes of perturbation will be initial errors in altitude and gravitational attraction to the moon. Velocity errors at the start of the orbit-maintaining phase also lead to periodic displacements. Evaluations of these perturbations and the search for ways of correcting them are being conducted. M.P.G.

N65-24350# Joint Publications Research Service, Washington, D. C.
THE "DECCA" RADIO NAVIGATION SYSTEM IN MARINE NAVIGATION
A. Pavlon 24 May 1965 14 p Transl. into ENGLISH from Morsk. Flot (Moscow), no. 2, Feb. 1965 p 24–27
(JPRS-30201; TT-65-31053) CFSTI: $1.00

The technological development of an automatic track plotter and a marine receiver indicator, for incorporation into the Decca radio navigational system (RNS), is reported. Also reported is a method for eliminating ambiguity in the receiver indicator. A review of the technological development and operating principles of the phase RNS, the Decca phase RNS, and the M-V receiver indicator is included. S.C.W.

N65-24378*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INVESTIGATION OF A MANUAL SEXTANT-SIGHTING TASK IN THE AMES MIDCOURSE NAVIGATION AND GUIDANCE SIMULATOR
Bedford A. Lampkin and Robert J. Randle Washington, NASA, May 1965 39 p refs
(NASA-TN-D-2844) CFSTI: HC $2.00/MF $0.50

The Ames Midcourse Navigation and Guidance Simulator has been used for defining problem areas associated with sextant sightings in a space navigation scheme, and for determining the relative accuracy of sextant sightings taken with a hand-held sextant and with a gimbaled sextant. Sightings of this type would be used for determining the trajectory of a translunar or an interplanetary vehicle. The data indicate that, while the sextants used in this investigation require refining, they could probably be incorporated into a space navigation system. While the gimbaled sextant was slightly favored over the hand-held sextant, the hand-held sextant provided nominally as accurate sighting data as did the gimbaled sextant. Within the limitations of this study there was little effect of vehicle rotational motion about a single axis on sighting repeatability. Author

N65-24382*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SECOND-ORDER PERTURBATION ANGLE TECHNIQUES FOR ACCURATELY SIMULATING SIGHTING PROBLEMS OF A SPACE SEXTANT
Richard L. Kurkowski and Kenneth C. Grover Washington, NASA, May 1965 65 p refs
(NASA-TN-D-2843) CFSTI: HC $3.00/MF $0.75

The performance of a vehicle-mounted servo-operated space sextant has been investigated with a fixed-cockpit analog-computer simulation. Computational accuracy of 1 arcsec was obtained with second-order perturbation angle techniques on the analog computer. A detailed description of the mathematical derivation is presented. Some typical results are included. The overall system, which incorporated a cathode ray tube display, had an accuracy level of ±2 arcsec with a man in the loop and no

vehicle or target motion. The effects of target and vehicle motion were studied, and indications were that for 3σ sighting accuracies of ± 10 arcsec or less, rates must be less than 200 arcsec/sec. Optical characteristics of the sextant were ×27 and 1.8° field of view. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N65-23595# Oak Ridge National Lab., Tenn.
REVIEW OF RADIOISOTOPES PROGRAM, 1964
J. H. Gillette May 1965 69 p refs
(Contract W-7405-ENG-26)
(ORNL-3802) CFSTI: $3.00

Discussed are *Reactor-Produced Isotopes; Cyclotron-Produced Isotopes; Radioisotope Generators; Half-Life of Cesium-137; Distribution Coefficients; Elution of Carrier-Free Indium; The (n,γ) Burnup of Promethium-146 in Promethium-147; Computer Programming for Isotopes Calculations; Radioisotope Technology—Process Improvement, Source Development, Ionization Chamber Calibration, Fission Products Development Laboratory, and Radioisotope Fuels Environmental Test Laboratory; Radioisotope Safety—Source Classification System; Shipping Container Testing, and Cesium-137 Thermoelectric Generator;* and *Isotopes Information and Quarterly Review.* G.G.

N65-23597# Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM RECYCLE CRITICAL FACILITY FINAL SAFEGUARDS ANALYSIS, SUPPLEMENTS
F. Swanberg ed. Oct. 1964 111 p refs
(Contract AT(45-1)-1350)
(HW-69168, Suppl.) CFSTI: $4.00

The results of analyses of the nuclear characteristics of heavy water moderated plutonium recycle critical facility cores including all Pu fuel loading are reported. Moderator void formation and the negative fuel temperature coefficient of reactivity are shown to be sufficient to arrest the excursion, assuming failure of the safety circuit. Also, detailed safeguards analyses for critical experiments with light water moderator in the Pu recycle critical facility are presented. Nuclear excursions with PuO_2–UO_2 fuel to be used in the experimental boiling water reactor are analyzed. Further, the studies related to light water moderated cores with mixed oxide fuel are extended. Finally, analyses of critical experiments for the Pu recycle critical facility are reported for light water moderated plutonium–aluminum fuel loadings with enrichment levels of 1.8% and 5.0% Pu. E.E.B.

N65-23601# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
ANALYSIS OF THERMAL TRANSITION IN A NUCLEAR REACTOR [ANALISIS DE TRANSISTORIOS TERMICOS EN UN REACTOR NUCLEAR]
Arnaldo Blumenkrantz and Rosa F. Turjanski 1965 38 p refs In SPANISH
(Rept.-134)

A study of temperature evolution of fuel elements during the thermal excursion of a nuclear reactor following an accident was undertaken. High temperatures will destroy the fuel element capsules and the subsequent fission product diffusion will contaminate the entire system. Methods for cooling the nuclear reactor in the event of an accidental pump failure which causes dangerously high temperatures are discussed. R.N.A.

N65-23646# Los Alamos Scientific Lab., N. Mex.
IRRADIATION DAMAGE TO CERAMICS, METALLIC–CERAMIC BONDS, AND BRAZING ALLOYS
Alton J. Patrick 26 Apr. 1965 49 p refs
(Contract W-7405-ENG-36)
(LA-3285-MS) CFSTI: $3.00

Irradiation damage to ceramics, metallic–ceramic bonds, and brazing alloys is described for a temperature range of 700° to 970° K. Data are presented for an accumulated thermal neutron flux from 1.36×10^{21} to 2.77×10^{21} and for an accumulated fast neutron flux (> 1 MeV) from 1.5×10^{20} to 3.17×10^{21}. In this range the samples tested of BeO, MgO, magnesia spinel, and Y_2O_3 were found unsatisfactory. The 97.5% Al_2O_3 (Al-300), 98% Al_2O_3 + 2% Y_2O_3 (Al-13), and 99.5% Al_2O_3 + 0.5% Y_2O_3 (Al-14) were found the most resistive to irradiation damage. The electrical resistivity of the ceramics tested was lower after irradiation. Author

N65-23734# Reactor Centrum Nederland, The Hague.
NERO DEVELOPMENT PROGRAMME, JANUARY 1963 TO JUNE 1964
Brussels, EURATOM, Feb. 1965 66 p
(Contract EURATOM-007-61-6 PNIN)
(EUR-2180.e) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 85 Belg. Fr.

After a discussion of the general features of the interim design, called NEREUS, and of the NERO target design, the areas of core development, system and component development and of design work and calculations are reviewed. In the field of core development the critical experiments are reported, including studies of the effect of burnable poison on core parameters. The incorporation of burnable poison in the fuel is also discussed. Irradiation experiments and corrosion performance tests are other items of the core development program. In the system and component development programs, emphasis was on the steam generator performance test installation, on the preparation of pressurizer performance tests and on water quality control. In the design area, studies were made of power distribution, burn-up, heat transfer and hydraulics. A completed study of dynamics and control allows detailed safety analysis of the reactor system. Design of the primary system and many of the auxiliary systems is also reported. Author

N65-23847# Atomic Energy of Canada, Ltd., Chalk River, Ontario.
METHODS OF DOSIMETRY AND FLUX MEASUREMENT AND THEIR APPLICATION IN THE NRX REACTOR
A. W. Boyd, H. W. J. Connor, and J. J. Pieroni Jan. 1965 42 p refs
(CRC-1210; AECL-2203) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.50

Energy deposition rates in the NRX reactor were determined using calorimeters, graphite–CO_2 ion chambers and the radiolytic hydrogen yield from cyclohexane and are in good agreement. Two types of calorimeters and the ion chamber are described, circuits and saturation curves for the ion chamber are given, and the dependence of the cyclohexane hydrogen

yield upon dose rate and dose is shown. Thermal neutron fluxes were determined with cobalt (37 b), fast fluxes using the $Ni^{58}(n,p)Co^{58}$ reaction (90 mb). Author

N65-23853# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant
Y-12 RADIATION SAFETY MANUAL
P. C. Mc Ree, C. M. West, and J. D. Mc Lendon, ed. 11 May 1965 116 p refs
(Contract W-7405-ENG-26)
(Y-1401, Rev.) CFSTI: $4.00

Presented is the radiation safety manual which is designed to protect personnel from exposure to ionizing radiation and/or radioactive materials, industrial toxicants, or other environmental factors which may cause sickness, impair health and well-being, or cause inefficiency among plant workers. A comprehensive outline of the programs or methods by which the Health Physics Department discharges its responsibilities with regard to fulfilling the policies of the Y-12 plant is reported. Among the programs discussed are the external and internal radiation monitoring programs, the plant site monitoring and contamination control program, and the process area monitoring and contamination control program. The current control programs conducted by the Industrial Hygiene Section to protect personnel from nonradioactive hazards are also described. The scope of these programs varies in size from small pilot-plant and development operations to entire building operations. Also discussed are the beryllium program, the mercury and lead programs, and the noise control program. S.C.W.

N65-23881# Battelle Memorial Inst., Columbus, Ohio.
MODEL STUDIES OF FLOW IN PWR CORE 2 FUEL ASSEMBLIES
Lawrence J. Flanigan, Clarkson L. Coffin, and William D. Beck 30 Mar. 1965 38 p
(Contracts W-7405-ENG-92; AT(11-1)-GEN-14)
(BMI-1720) CFSTI: $1.00

Approximately 3.5-scale flow models, with air as the working fluid, were used to determine the magnitude of channel-to-channel flow maldistribution within the assemblies which occurred as a result of the geometric transition from a circular to a square cross section upstream of the coolant-channel inlets. Channel flow-distribution data were obtained by comparison of the flow distribution obtained with a uniform velocity over the entrance to all coolant channels with that obtained with the round-to-square transitions installed upstream of the fuel clusters. Channel-to-channel flow maldistribution in both the seed and blanket fuel assemblies was determined for four levels of fuel-channel resistance ranging from 10% to 100% of reactor fuel pressure loss. Flow maldistribution in the blanket fuel channels was also determined for various flow-control-orifice settings. The flow distribution data are presented in curve form on plan views of the fuel clusters. Author

N65-23885# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Development Center
IRRADIATION PERFORMANCE OF THORIA-URANIA FUEL MATERIALS Quarterly Technical Report No. 2, 1 Oct.–31 Dec. 1964
B. W. Whitaker [1964] 51 p refs
(Contract AT(30-1)-3376)
(BAW-3376-2) CFSTI: $3.00

Thermal conductivity and gas retention and release characteristics of sol-gel thoria-urania fuel are emphasized. Pelletized fuel is examined to standardize experimental equipment and to provide data for correlation with available information. Equipment fabrication and initial operational trials constituted the major effort. The bench test equipment for initial examination of fuel permeability to fission gas was operated successfully at controlled temperatures using helium as the permeating gas. Sorbed gas release apparatus design was completed, and the system fabricated. Several fuel specimens were degassed, and the analytical equipment was standardized. The unirradiated fuel thermal conductivity apparatus was designed. Completed hazards report calculations are being integrated into the safety analysis of the irradiation experiments. The dynamic gas release experiment has been designed, and calculations for the hazards evaluation initiated. Author

N65-23893# Societa Richerche Impianti Nucleari, Saluggia (Italy).
UTILIZATION OF SORIN'S POOL TYPE REACTOR AVOGARDO RSI AT SALUGGIA
A. Rossi and H. Walter 1963 33 p refs Presented at the IAEA Study Group Meeting on Res. Reactor Util., Athens, 9–13 Sep. 1963
(SORIN-23)

Current research programs include nuclear metallurgy and technology, radiochemistry, radiation chemistry, physics, and mathematics. The present paper summarizes qualitatively that part of the program using the 2-MW swimming pool reactor. Considerations are presented on its utilization level, which is considered satisfactory. A bibliography of published work performed with the reactor is given. Author

N65-23894# Societa Ricerche Impianti Nucleari, Saluggia (Italy).
NEUTRON DIFFRACTION WORK AT THE AVOGADRO RSI REACTOR OF THE SORIN CENTER [LAVORO IN DIFFRAZIONE NEUTRONICA AL REATTORE AVOGADRO RSI DELLA SORIN]
G. Carraro (Soc. Vetrocoke, Porto Marghera), M. Domenici, and T. Zucca 1964 32 p refs In ITALIAN; ENGLISH summary Presented at the Conv. of the Phys. of Reactors, Milan, 28 Nov.-1 Dec. 1963
(SORIN-46)

Work performed or in progress is reported, starting from the installation and calibration of the neutron diffraction equipment. Particular attention is given structural studies of amorphous and semicrystalline solids, such as vitreous silica and multicomponent glasses, polymers, and pyrocarbon. In the experimental data processing and interpretation use was made of calculation programs for the automatic computer Elea 6001. Author

N65-23973# General Dynamics/Fort Worth, Tex.
COMPUTER CODES FOR REACTOR AND HAZARD ANALYSES AT NARF Technical Report, 1 Oct. 1963–30 Sep. 1964
J. W. Mc Whirter Kirtland AFB, N. Mex., AF Weapons Lab., Mar. 1965 33 p refs
(Contract AF 29(601)-6213)
(FZK-211; WL-TR-64-138; AD-613983)

A number of computer codes obtained from other facilities were modified for computer utilization at the Nuclear Aerospace Research Facility (NARF). The following codes are presently operational and are, therefore, part of the NARF's reactor and hazard analysis capability: (1) RISC, Radiological Inhalation Safety Code; (2) AIREK-III, Reactor Kinetics Code; (3) FAIM, One-Dimensional Multigroup Neutron Diffusion Code; (4) 9-ANGIE, Two-Dimensional Multigroup Neutron Diffusion

Code; (5) MLFTHAN, Heat-Transfer Code; (6) DTK, One-Dimensional Multigroup Neutron Transport Code; and (7) DDK, Two-Dimensional Multigroup Neutron Transport Code. This report describes the characteristics of these codes to indicate the services available at NARF. Author

N65-23976# Societa Ricerche Impianti Nucleari, Saluggia (Italy).
NEUTRON IRRADIATION EXPERIMENTS AT 78°K ON Al AND Al ALLOYS [ESPERIENZE DI IRRAGGIAMENTO NEUTRONICO A 78°K SU ALLUMINIO E SUE LEGHE]
F. Pieragostini 1964 21 p refs In ITALIAN; ENGLISH summary Presented at the Conv. on the Phys. of Reactors, Milan, 28 Nov.–1 Dec. 1963
(SORIN-45)

The liquid nitrogen cryostat which serves mainly for irradiations of solids at low temperature is described. Results of research on effects of neutron irradiation at 78° K on pure Al 99.995% and on various binary Al alloys are reviewed. Author

N65-23978# Gesellschaft für Kernenergieverwertung, Hamburg (West Germany).
SHIELDING EXPERIMENTS AT THE REACTOR STATION GEESTHACHT Annual Report, 1963
E. Bagge Brussels, EURATOM, Dec. 1964 183 p refs in GERMAN; ENGLISH summary
(Contract EURATOM-002-61-1 PNID)
(EUR-2197.d) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 250 Belg. Fr.

Measurements were made on 11 different shielding arrangements. Tables were compiled giving a first rough view of the shielding properties of several different material combinations. The optimal volume ratio of metal to hydrogen-containing components was found. The reactor available for experiments had a reactor power of up to 200 kW. As the activity of the fuel elements was still relatively low, the spectrum of the prompt gamma radiation was measured with a three-crystal pair spectrometer. For further shielding research the radiation field of FRG-2 was measured in water. The gamma radiation was additionally measured with fluorescence-glass-dosemeters, the fast neutron flux in water using the O^{16} (n,p) n^{16} reaction. The very different decrease of the neutron and gamma intensity in water was utilized to find evidence of the contribution of the secondary gamma rays from iron to the total dose rate. In the development of instruments for shielding experiments a proton-recoil spectrometer and the pair spectrometer used for gamma-measurements were built. The production of semiconductor-neutron-spectrometers was further developed. Theoretical work in calculating the shielding efficiency of different shields continued. Author

N65-24011# Atomics International, Canoga Park, Calif.
SNAP TECHNOLOGY HANDBOOK. VOLUME III: REFRACTORY FUELS AND CLADDINGS
G. F. Burdi, comp. 30 Apr. 1965 146 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-8617, Vol. III) CFSTI: $5.00

This report contains currently available property data on high temperature nuclear reactor compounds (UC, UN, and UO_2), ceramic dispersions (Al_2O_3–UO_2 and BeO–UO_2), and cermet (Mo–UC, –UN, and –UO_2) fuels and potential claddings (Cb, Ir, Mo, Re, Ta, Ti, V, and W). Author

N65-24028# European Space Vehicle Launcher Development Organization, Paris (France).
CHARACTERISTICS OF CERTAIN RADIOISOTOPES USABLE FOR SPACE MISSIONS [CHARACTERISTIQUES DE CERTAINS RADIOISOTOPES UTILISABLES POUR DES MISSIONS SPATIALES]
J. P. Contzen Dec. 1964 13 p refs In FRENCH
(ELDO-TM-F-12)

Tables furnishing the principal characteristics of radioisotopes capable of being used in space, both for propulsion and for the production of auxiliary electrical energy, are presented. The physical and thermal nuclear properties of pure radioelements and their most usual compounds are examined, and the annual production capacity and the price of these isotopes are also given. Transl. by M.P.G.

N65-24029# European Space Vehicle Launcher Development Organization, Paris (France).
CHARACTERISTICS OF SOME RADIO-ISOTOPES SUITABLE FOR USE ON SPACE MISSIONS [CARACTERISTIQUES DE CERTAINS RADIO-ISOTOPES UTILISABLES POUR DES MISSIONS SPATIALES]
J. P. Contzen Jan. 1965 12 p refs In ENGLISH and FRENCH
(ELDO-TM-F-12, Addend.)

An addendum, modifying data given in a previous document, is presented. In Table I, *Nuclear, Physical and Thermal Characteristics of Pure Radio-Isotopes*, new values are reported for the ratio C_s in Ci/Wth and specific thermal power P_s in Wth/gr of thulium 170; and the maximum permissible concentration in air (MPC) in Ci/m^3. In Table II, *Physical and Thermal Characteristics of Compounds Used in Radio-Isotope Sources*, the isotopic purity value of thulium 170 is changed, thus altering the ratio R_w value. In Table III, *Isotope Availability and Cost*, new cost estimates for thulium 170, thorium 228, and curium 242 are presented. These new data have been incorporated into revised tables which are included in the supplement. S.C.W.

N65-24046# Montecatini Servizio Nucleare, Milan (Italy).
NUCLEAR GENERATORS OF SMALL AND MEDIUM POWER FOR SPACE USE: INVESTIGATION OF RESEARCH POSSIBILITIES AND RELATED DEVELOPMENT [GENERATEURS NUCLEAIRES DE PETITE ET MOYENNE PUISSANCE POUR EMPLOIS SPATIAUX: EXAMEN DES POSSIBILITES DE RECHERCHE ET DEVELOPPEMENT RELATIVES]
Alberto Vaudo 5 Apr. 1963 28 p refs In FRENCH

Present United States and European capabilities for production of electrical energy by nuclear generators which are characterized by low specific weight in relation to disposable power, and by long operating life, are described. Current research has enlarged the range of possible uses of such generators to include terrestrial, meteorological, submarine, and telephone power applications. United States use of solar and nuclear energy sources aboard space vehicles is reviewed, with respect to heat sources, conversion of heat to electrical energy, heat radiators, and applications of nuclear and radioisotope generators. The United States SNAP program and NASA contracting activities, and possible uses of nuclear energy in European space program, are discussed. J.M.D.

N65-24051# Eurospace, Paris (France).
PROPOSALS OF THE SERVICE NUCLEAIRE MONTECATINI FOR THE PRODUCTION OF AUXILIARY ENERGY WITH THE HELP OF RADIO-ISOTOPIC GENERATORS [PROPOSITIONS DU SERVICE NUCLEAIRE MONTECATINI POUR LA PRODUCTION D'ENERGIE AUXILIAIRE DE BORD A L'AIDE DE GENERATEURS A RADIO-ISOTOPES]
[1962] 6 p In FRENCH

The efficiency and cost of systems for the onboard conversion of the thermal energy of radioisotopes into electrical energy (from 1 to 1000 W) for satellite auxiliary systems are discussed in relation to the possibility of European development of such generators. The prime consideration is seen to be the predicted durations of the space missions. For missions between 100 days and a year, radioisotopes such as Po^{220}, Cm^{242}, or Tm^{170} should be considered; these are producible in Europe without difficulty or excessive cost, and generators using these isotopes could be operational in about three years. For longer missions from 2 to 10 years, isotopes such as Cm^{244}, Pu^{238}, Cs^{137}, and Sr^{90} should be surveyed to determine their technology requirements and relative costs. These generators will take longer to develop because of the great difficulties in providing the necessary radioelements in Europe. Work programs are proposed for the development of both types of generators. M.P.G.

N65-24068# Keuring Van Electrotechnische Materialen, N. V., Arnhem (Netherlands).
THE AQUEOUS HOMOGENEOUS SUSPENSION REACTOR PROJECT EURATOM-RCN-KEMA
J. J. Went, J. A. H. Kersten, M. E. A. Hermans, H. Wolf, J. J. Van Zolingen et al Oct. 1964 100 p refs Transl. into ENGLISH from "Atoomenergie en Haar Toepassingen", 1963
(Contracts EURATOM-001-59-12 NTAN; EURATOM-002-63-4 NTAN)
(EUR-1611.e) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 130 Belg. Fr.

CONTENTS:

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3. CHEMICAL ASPECTS OF THE HOMOGENEOUS SUSPENSION REACTOR PROJECT M. A. E. Hermans p 33–48 refs

4. ENGINEERING ASPECTS OF THE SUSPENSION REACTOR PROJECT H. Wolf p 49–64 refs

5. THE INSTRUMENTATION SYSTEM OF THE KEMA SUSPENSION TESTS REACTOR (KSTR) J. J. Van Zolingen p 65–77 refs

6. PROTECTION AGAINST RADIATION FROM THE KEMA SUSPENSION TEST REACTOR (KSTR) Hub. Wijker p 79–100 refs

N65-24074# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research
FRUSS–1000 MWe U_{nat} GAS-COOLED GRAPHITE MODERATED REACTOR WITH PRESSURIZED TUBES FOR SUPERCRITICAL STEAM PARAMETERS [FRUSS–1000 MWe REAKTOR GRAFITOWO-GAZOWY Z U_{nat} Z KANALAMI CISNIENIOWYMI NA PARAMETRY NADKRYTYCZNE]
Jerzy Lopuszynski Jul. 1964 21 p refs In POLISH; ENGLISH summary
(Rept.-543/IX)

This report proposes application of pressurized channels with enriched uranium superheating supercritical steam in a U_{nat}-gas-graphite reactor. This gives a reactor with many advantages: high steam parameters and high power density, small number of channels and large power unit, a good fuel cycle and low capital investment, etc. The main difficulties lie in obtaining remote joining and separation of the channels from the high pressure circuit and providing for accidental bursting of a pressure tube. Author

N65-24094# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE EFFECT OF UO_2 DENSITY ON FISSION PRODUCT GAS RELEASE AND SHEATH EXPANSION
M. J. F. Notley and J. R. Mac Ewan Mar. 1965 34 p refs
(AECL-2230) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.00

In an irradiation experiment, the performance of fuel elements with densities between 10.42 and 10.74 g/cm^3 was compared at $\int \lambda d\theta$ values of 39 and 42 W/cm. Because the elements were irradiated as clusters of four in a pressurized water loop, their irradiation histories were identical. That fission product gas release and extent of grain growth were greater for the lower density elements, is attributable solely to the variation of the thermal conductivity of the fuel with the fractional porosity p, if

$$\lambda_p = \lambda [1 - (2.6 \pm 0.8) p]$$

where λ is the thermal conductivity of fully dense UO_2 and λ_p is that of the porous UO_2. This expression agrees with laboratory findings. A correlation between the extent of grain growth in the UO_2 and the fractional gas release was found to exist in this test. Diametral sheath strain was lower for the low density fuel elements than for those of high density, although the former were deduced to have operated with higher central temperatures. The data are consistent with the assumption that approximately half the porosity in the region of the fuel undergoing grain growth is eliminated. Author

N65-24234# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
NONDESTRUCTIVE TEST OF CARBON BEDS FOR REACTOR CONTAINMENT APPLICATIONS Progress Report, Jul.–Sep. 1964
David R. Muhlbaier Apr. 1965 17 p refs
(Contract AT(07-2)-1)
(DP-950) CFSTI: $1.00

A standardized nondestructive and generally applicable test for installed carbon beds in reactor containment facilities is being developed. Continuing tests show that the permissible ranges of air velocity and H_2O content of the carbon can be extended to encompass the desired test conditions for installed beds of new carbon. The major improvement reported is that of substituting F-112 or F-113 for F-12—a more volatile Freon used in an earlier testing method. Author

N65-24235 Los Alamos Scientific Lab., N. Mex.
REACTOR MINIMUM CRITICAL DIMENSIONS
Carroll B. Mills 17 Apr. 1965 54 p refs
(Contract W-7405-ENG-36)
(LA-3221-MS) CFSTI: $3.00

A parametric study of minimum critical reactor dimension as a function of moderator, fissionable isotope, and size was made, based on a consistent variety of critical experiments.

Minimum critical size and mass were computed for a range of concentration of U^{233}, U^{235}, and Pu^{239} for H_2O-moderated bare and reflected slab, cylinder, and sphere geometries, as well as corresponding results for U^{235} and heavier atom moderators D_2O, Be, BeO, and C. Some results are presented of the same sort for D_2O, Be, and C reflector-moderated reactors. Author

N65-24248# Argonne National Lab., Ill.
IRRADIATIONS OF U–20Pu–10Fs ALLOY FUEL RODS
W. N. Beck, J. H. Kittel, and R. J. Fousek. Feb. 1965 36 p refs
(Contract W-31-109-ENG-38)
(ANL-6750) CFSTI: $2.00

Instrumented capsule irradiations were performed with uranium–20 wt% plutonium–10 wt% fissium compositions sodium bonded to various high-temperature jacketing alloys. The specimens were EBR-II-diameter fuel rods that had been reduced to a 51-mm fuel length. The jacketing materials tested were niobium, Nb–1 wt% Zr alloy, Nb–33 wt% Ta–1 wt% Zr alloy, Nb–4 wt% V alloy, vanadium, molybdenum, Ta–0.1 wt% W alloy, Inconel-X, Type 304 stainless steel, and Hastelloy-X. A total of 78 specimens were irradiated over a temperature range of 420° to 900°C and burnups of 1.2 to 4.2 at.% heavy metal. Other specimens presently under irradiation exceeded burnups of 7.2 at.% without indication of failure. It was found that rupture strength of the jacketing material is not the only criterion of the restraint characteristics of the jacket during irradiation. The optimum relationship appears to be a jacket that retains a high rupture strength with a high degree of ductility. Lifetime of the fuel specimens before failure occurred was significantly extended by increasing the void space within the jacket. Author

N65-24257# AiResearch Mfg. Co., Phoenix, Ariz.
SNAP 50/SPUR Quarterly Technical Progress Report, Period Ending Dec. 31, 1964
15 Apr. 1965 65 p refs
(Contracts AF 33(615)-2289; AF 33(615)-1551)
(APS-5152-R1, Suppl. 1; AD-455534)

The preliminary design of a static frequency converter and a heat rejection system for the SNAP 50/SPUR powerplant, is reported. Data on system considerations, converter design, circuit demonstration, and design feasibility are included. Supplementary data on nuclear radiation tolerance of the converter components, and the feasibility of cable design for high-freqency power transmission are discussed. S.C.W.

N65-24280 United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
FISSION GAS EMISSION FROM UO_2 DURING IRRADIATION AT 800–1600°C
G. Jackson, D. Davies, and P. Biddle Dec. 1964 64 p refs
(AERE-R-4714) HMSO: 9s

An in-pile rig for the continuous monitoring of noble gases released from uranium dioxide at high temperatures is described. Two samples, of density 7.90 g/cm^3 and 10.48 g/cm^3, were irradiated at 200°C temperature steps from 800° to 1400° and 1600°C, respectively. The release of ^{85m}Kr, ^{87}Kr, ^{88}Kr, ^{133}Xe, and ^{135}Xe was measured, and that of ^{133}I and ^{135}I estimated. The release was separated into temperature-independent and temperature-dependent components, and diffusion coefficients were calculated for the latter. A comparison was made with postirradiation heating results from similar samples. The diffusion coefficients for xenon were lower than those obtained in the postirradiation experiments. A high proportion of the 135, 133 isobares was released from the fuel as iodine. Author

N65-24290# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
DETERMINATION OF ALUMINIUM IN REPROCESSING SOLUTIONS OF THE COMBUSTIBLE ELEMENTS OF A RA-1 TYPE REACTOR [DETERMINACION DEL ALUMINIO EN SOLUCIONES DE REPROCESDAMIENTO DE LOS ELEMONTOS COMBUSTIBLES DE UN REACTOR TIPO RA-1]
Jaime Casabé 1965 20 p refs In SPANISH
(Rept.-136)

A method to determine aluminum in solution originating from a dissolution of fuel elements from a nuclear reactor is presented. Aluminum is separated from uranium and iron by means of an anion exchange resin and titrated with ethylenediaminetetraacetic acid, redissolved with zinc solution, and potentiometrically determined to the end point. R.N.A.

N65-24332# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING FEBRUARY, 1965
Russell W. Dayton and Stan J. Paprocki 1 Mar. 1965 46 p ref
(Contract W-7405-ENG-92)
(BMI-1717 (Del.)) CFSTI: $1.00

CONTENTS:
1. REACTOR MATERIALS AND COMPONENTS (AEC-DRD) E. S. Hodge 8 p
2. STUDIES OF FUELS (AEC-DRD) D. L. Keller 9 p
3. RADIOISOTOPE AND RADIATION APPLICATIONS (AEC-DID) J. F. Kircher 2 p
4. COATED-PARTICLE FUEL MATERIALS (AEC-DRD) R. W. Dayton, J. H. Oxley, and C. W. Townley 19 p ref
5. GAS-COOLED REACTOR PROGRAM (AGN) D. L. Keller 3 p

N65-24345# Los Alamos Scientific Lab., N. Mex.
FEASIBILITY STUDY OF A PULSED THERMONUCLEAR REACTOR
F. L. Ribe, T. A. Oliphant, Jr., and W. E. Quinn 20 May 1965 57 p refs
(Contract W-7405-ENG-36)
(LA-3294-MS) CFSTI: $3.00

The minimal conditions of burning time, plasma temperature, and number density yielding net energy balance in a pulsed reactor are investigated. The analog of a θ pinch is considered in which a long cylinder of $\beta = 1$ plasma is contained by a magnetic field, furnished by a single turn coil. The basic energy losses are joule heating of the coil by the magnetic field, heating of the coil by neutrons as they pass through it to the neutron blanket, and bremsstrahlung. The basic energy source is kinetic energy of the neutrons from d-t fusion reactions. Fuel burnup and α-particle heating of the plasma are also considered. Heat is removed from the beryllium–copper coil by means of turbulent flow of supercritical H_2O in channels. Two basic electrical models of the pulsed reactor are taken. In the first, all of the magnetic field B is furnished by the coil. In the second, the sustained-field θ pinch, a steady magnetic field is suddenly pulsed off by an opposite magnetic impulse of short duration. Author

N65-24346# Los Alamos Scientific Lab., N. Mex.
CRITICAL ASSEMBLIES OF FISSIONABLE MATERIALS
Carroll B. Mills 7 Apr. 1965 23 p refs
(Contract W-7405-ENG-36)
(LA-3219-MS) CFSTI: $2.00

A number of critical assemblies were studied for reactor safety and criticality evaluation reasons early in the nuclear-powered rocket development period. These were all of the H_2O-moderated U^{233}, U^{235}, and Pu^{239} critical experiments and the relatively few D_2O-, Be-, BeO-, and C-moderated, enriched U^{235} critical experiments available that provided simple parametrics and extremes in type. The atomic densities and dimensions directly useful for computational purposes are listed for fast to thermal flux spectrum assemblies. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N65-23372 Joint Publications Research Service, Washington, D. C.
REGGE ACTION OF HIGH SINGULARITY POTENTIAL AND NON-REGIONAL POTENTIAL
Yuan-pen Tai *In its* Transl. on Communist China's Sci. and Technol. 19 Apr. 1965 p 1–22 refs (See N65-23371 13-34) CFSTI: $3.00

Interaction in the field theory is investigated by the original potential, which is higher than the region potential of the two regional poles and a type of nonregional potential. It is proven that the S-matrix $S(\lambda,k)$ in the whole λ-plane is half pure for the first case, and that there are infinite roots in the small angular region of the imaginary axis. The real and imaginary parts of the angle of the poles are both approaching ∞ and therefore, the Watson–Sommerfeld transformation does not exist for the z^{-4} repulsion potential. It was found that the nonregional potential $S(\lambda,k)$ is half pure on the right side of the λ-plane in the second problem. The Regge poles seem to be located in the fourth quadrant in the cases on asymptotic characteristics of $S(\lambda,k)$ when $\lambda \to \infty$, on the analysis of the variable k, and on the locations of the poles. G.G.

N65-23402# Joint Publications Research Service, Washington, D. C.
ENGINEERING JOURNAL, VOLUME IV, NUMBER 4, 1964
26 Apr. 1965 206 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 4, no. 4, 1964
(JPRS-29763; TT-65-30823) CFSTI: $6.00

Selected articles on aerodynamics, thermodynamics, and thermoelastics are presented. For individual titles see N65-23403–N65-23421.

N65-23408 Joint Publications Research Service, Washington, D. C.
CONCENTRATION OF STRESSES IN SEMI-INFINITE REGIONS
N. S. Kudrin *In its* Eng. Journal 26 Apr. 1965 p 58–66 refs (See N65-23402 13-23) CFSTI: $6.00

Stress condition in semi-infinite regions (plane problem of the elasticity theory) with concentrated forces acting on the boundaries is determined. The investigation is conducted so that a part of the results obtained can be used in solving problems for the case of load distribution. Regions with different factors of stress concentration are considered, and the solution is obtained in a closed form. Numerical examples are given. R.C.S.

N65-23409 Joint Publications Research Service, Washington, D. C.
APPROXIMATE SOLUTION OF THE THERMOELASTIC PROBLEM FOR A ROTOR OF FINITE LENGTH
V. I. Danilovskaya *In its* Eng. Journal 26 Apr. 1965 p 67–73 refs (See N65-23402 13-23) CFSTI: $6.00

The approximate method of solving spatial problems of thermoelasticity based on the use of the variation principle of Kastil'yona is presented. The tensors of stresses used are divided into two groups, the primary and correcting tensors. The combined tensors satisfy the equations of equilibrium, marginal and zero boundary conditions, and contain a number of varied parameters. The problem of purely temperature stresses in a body due to uneven heating is studied. Since only the correcting tensor is required for temperature stresses, the components of the correcting tensor will depend on coordinate points in which the stress conditions and parameters are studied. The method presented allows the problem to be reduced to a numerical result. R.C.S.

N65-23419 Joint Publications Research Service, Washington, D. C.
FORCED OSCILLATIONS OF A MECHANICAL SYSTEM IN THE PRESENCE OF "DRY" FRICTION AND AN ASYMMETRIC, QUASI-ELASTIC CHARACTERISTIC
G. V. Mishenkov *In its* Eng. Journal 26 Apr. 1965 p 175–183 refs (See N65-23402 13-23) CFSTI: $6.00

In the case of some mechanical systems the problem of forced oscillations can be reduced to an ordinary differential equation with an asymmetric, quasi-elastic characteristic. With the use of slowly varying amplitude are outlined periodic solutions of such control, applicable in the case of dry friction. The stability of the solutions so obtained is investigated, and the case examined in which there are two stable positions of equilibrium. Author

N65-23500# Joint Publications Research Service, Washington, D. C.
ENGINEERING JOURNAL, VOLUME V, NO. 1, 1965
A. A. Nikol'skiy, ed. 30 Apr. 1965 276 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 5, no. 1, Jan.–Mar. 1965 (JPRS-29837; TT-65-30860) CFSTI: $6.00

Selected articles on aerodynamics, mechanics, elasticity, and plasticity are presented. For individual titles see N65-23501–N65-23524.

N65-23501 Joint Publications Research Service, Washington, D. C.
ON THE STABILITY OF DISC MOVEMENT
A. P. Duvakin *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 1–11 refs (See N65-23500 13-01) CFSTI: $6.00

The necessary and sufficient conditions for the stability of the steady-state motions of a disc over an absolutely rough horizontal surface are established. It is shown that the steady-state motions of the disc form a two-parameter family of motions, and a geometric interpretation of the stability conditions is presented. The method of Lyapunov is used in the determination of the sufficient stability conditions. Graphs are presented which indicate the regions of stability of the motions of a thin homogeneous disc. Author

N65-23502 Joint Publications Research Service, Washington, D. C.
ON THE STABILITY OF THE POSITIONS OF DYNAMIC EQUILIBRIUM OF A PARTICULAR MECHANICAL SYSTEM
Van Chjao Lin *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 12–20 refs (See N65-23500 13-01) CFSTI: $6.00

Consideration is given the stability of rotation of a solid body suspended on a string using the method of the study of the stability of the relative equilibrium and of the steady-state motion of the mechanical system. Two cases are considered of the relative equilibrium of a solid body suspended on a string whose upper end is rigidly clamped along the axis of the vertical shaft of a motor where the moment of the forces acting on the motor shaft is such that during the time of motion the angular velocity of rotation of the solid body about the vertical remains constant. Then, for the absolute motion of the system resulting from the rotation of the motor, the energy integral and the area integral of the mechanical system do not exist.
Author

N65-23506 Joint Publications Research Service, Washington, D. C.
CALCULATION OF SEDIMENTATION UNDER THE ACTION OF THE FORCE OF GRAVITY IN THE CASE WHEN THE VISCOSITY DEPENDS ON THE CONCENTRATION FOLLOWING THE EINSTEIN LAW
V. K. Turkin *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 64–85 refs (See N65-23500 13-01) CFSTI: $6.00

The present study is devoted to the mathematical investigation of the process of sedimentation under the action of the force of gravity of small solid particles from a colloidally dispersed system and the associated changes of concentration of the solid phase in the liquid.
Author

N65-23515 Joint Publications Research Service, Washington, D. C.
OPTIMAL THREE-IMPULSE CHANGE OF CIRCULAR ORBIT PLANE WITH THE APPLICATION OF THRUST IMPULSES ON PASSAGE OF NODAL LINES
L. V. Zakoteyeva and V. V. Polyachenko *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 208–213 refs (See N65-23500 13-01) CFSTI: $6.00

A three-impulse method of rotating a vehicle's circular orbit without changing the radius is studied theoretically. The impulses are applied in sequence: the first impulse, applied as the vehicle passes the line of the nodes of the initial and final orbits, transfers the vehicle into an elliptical orbit; at the apogee of the transfer orbit, the second impulse rotates the plane by a specified angle; and the third impulse, at the perigee of the transfer orbit, moves the vehicle into a new circular orbit with the radius of the initial orbit. An expression for the characteristic velocity of this maneuver, relative to the initial orbital velocity, is given. The relation is given for determining the optimal ratio between the initial orbit radius and the apogee radius of the transfer ellipse which minimizes the characteristic velocity. The relative characteristic velocity is plotted as a function of angle of plane rotation. A plot shows the relative time of the maneuver as a function of rotation angle.
J.M.D.

N65-23520 Joint Publications Research Service, Washington, D. C.
THE CONTACT THERMOELASTIC PROBLEM FOR A SEMISPACE
A. F. Khrustalev *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 245–249 refs (See N65-23500 13-01) CFSTI: $6.00

Theoretical solution to the contact thermoelastic problem for a semispace pressed by an absolutely rigid punch of arbitrary planform is derived. Subject to specified boundary conditions, the stationary temperature field of the semispace is presented in the form of a dirichlet integral. Differential equations are formulated for the stresses and displacements for the temperature field, and from additional boundary specifications a dirichlet integral is derived for the thermoelastic potential of the displacements. From the expression for a stress parameter, it was concluded that for determination of the normal contact thermoelastic stresses in an arbitrary region of contact, it is sufficient to know the elastic stresses and punch temperature corresponding to the condition of zero temperature outside the contact region.
J.M.D.

N65-23521 Joint Publications Research Service, Washington, D. C.
ON THE PENETRATION OF A HEATED PUNCH INTO AN ELASTIC SEMIPLANE
N. M. Borodachev *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 250–255 refs (See N65-23500 13-01) CFSTI: $6.00

Penetration of a heated punch of arbitrary shape into an elastic body occupying a semiplane is analyzed theoretically. Change in temperature for the punch and the semiplane are taken to be even functions satisfying a particular Laplace differential equation. Boundary conditions are stated for the projection of the displacement vector along the surface bounding the punch, the temperature of the semiplane, and the normal and tangential stresses; the stress requirements specify that there is no load on the semiplane outside of the punch. These conditions lead to an integral for the normal stress, which is the solution to the problem in general form. An example is worked in which the punch is a long circular cylinder, and equations are derived for the semiwidth of the area of contact and for the normal stress at any point in the contact area; conditions for nonappearance of tensile stresses on the contact surface is found.
J.M.D.

N65-23588# Massachusetts Inst. of Tech., Cambridge.
RESEARCH IN MATERIALS SCIENCE AND ENGINEERING Annual Report, 1964–1965
Apr. 1965 382 p refs
(Contracts NAS3-2590; DA-19-020-AMC-0231(X); AF 04(694)-553; AT(30-1)-956; Grant NSF G-2777 et al)
(AD-462001)

The bulk of inhouse research on materials science and engineering is reported under the following subjects: *Chemical and Solid-State Physics; Electric, Magnetic, and Optical Properties and Applications to Devices; Metallurgy and Materials Science; Materials Engineering; National Magnet Laboratory; Instrumentation Laboratory; Lincoln Laboratory;* and *Central Facilities.*
E.E.B.

N65-23663*# Florida Univ., Gainesville.
LOWER BOUNDS TO ENERGY EIGENVALUES FOR THE STARK EFFECT IN A RIGID ROTATOR
Jong H. Choi and Darwin W. Smith [1965] 16 p refs
(Grant NsG-512)
(NASA-CR-62664) CFSTI: HC $1.00/MF $0.50

The lower bounds to the energy eigenvalues for the rigid rotator in an electric field (the Stark effect) are calculated using the method of Löwdin.
Author

N65-23769# Harry Diamond Labs., Washington, D. C.
EFFECT OF SPACE CHARGE UPON TRANSPORT OF CHARGE CARRIERS

A. L. Ward 15 Jan. 1964 28 p refs
(HDL-TR-1195; AD-429851)

Numerical machine calculations were made that determine the effect of space charge, composed of mobile charge carriers, on the drift and diffusion of those carriers in an electric field. An apparent diffusion of carriers arises from the difference equations used to solve the transport problem, even though no diffusion term is included in the transport equations. This calculated diffusion is shown to be exact in the absence of space charge and in the limit of infinitely small calculation intervals. Numerical results illustrating the effect of space charge upon apparent diffusion coefficients and drift velocities are given for a fictitious gas. Calculations show good agreement with experimental data to measure attachment coefficients in gases. Exploratory calculations indicated the usefulness of this model for calculations in solid-state transport. Author

N65-23912# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
MAGNETIC FIELD COMPUTATIONS FOR UNIFORMLY MAGNETIZED BODIES WITH ODD SHAPES
Vivian O'Brien Nov. 1964 49 p refs
(Contract NOw-62-0604-c)
(TG-630; AD-458418)

The magnetic flux function was used to determine the axisymmetric fields generated by a number of rotationally symmetric uniformly magnetized bodies. In some cases an exact direct solution is possible in coordinates appropriate to the body; in others, an indirect exact approach yielded various nonspherical bodies. A point-wise approximate method was also considered. Author

N65-23953# European Space Vehicle Launcher Development Organization, Paris (France).
FORMAL CONSTRUCTION OF THE SMOOTHING POLYNOMINAL FOR ANY NUMBER OF READINGS IN WHITE NOISE
E. Cambi Nov. 1964 11 p
(ELDO-TM-F-10)

A general numerical procedure is presented which expresses in terms of the number of readings, the smoothing weights to be assigned to each reading of a set. The expected performance as given by the resulting variance under the assumption of incoherency of the errors is included. E.E.B.

N65-24032# Sud-Aviation, Paris (France).
ROTATION-ARRESTING DEVICE (YOYO) [DISPOSITIF D'ARRET DE ROTATION (YOYO)]
[1963] 13 p In FRENCH
(DTS/ES-70-629/63)

A yoyo-type apparatus designed to restrain, stop, or reverse the rotation of a body turning on an axis is described. It consists of a small circular mass attached to the end of a line rolled on a drum concentric to the axis of rotation. For a given direction of rotation, two directions of unrolling of the line are possible, but only one has any effect on the rotating body. At the instant restraint of the rotation of the body is desired, the small mass is released and the line unrolls. Preliminary calculations assuming that the line is without mass show that the line unrolls itself at a constant speed, and the length of the line required to annul the rotation is independent of the speed of rotation of the body. The point at which tension in the line reaches a maximum is calculated. Further calculations describe the case in which a mass is assigned to the line; the mass when the line is completely unrolled is used in determining the factors in the previous calculations which are affected by the mass of the line. Only the length of the line, the speed of rotation of the body, and the tension in the line are affected; the speed of unrolling of the line remains constant in both cases. Calculations for the use of two yoyo devices on the same rotating body show that the pulling forces no longer influence the movement of the center of gravity. M.P.G.

N65-24075# ARO, Inc., Arnold Air Force Station, Tenn.
CONSIDERATIONS IN THE MEASUREMENT OF CRYOPUMPING CAPTURE COEFFICIENTS
J. D. Haygood and J. P. Dawson Arnold Eng. Develop. Center, Apr. 1965 32 p refs
(Contract AF 40(600)-1000)
(AEDC-TR-65-68; AD-461132)

A survey is presented of the more important practical and theoretical relationships involved in the study of cryopumping. Starting with a rigorous definition of the capture coefficient, the effects of temperature on the measured values are derived. Several practical points in the design of a chamber for cryopumping measurements are given, including cryosurface and gage placement, calibration, effects of outgassing and impurities, and temperature measurements. Author

N65-24109*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF THE MAGNETIC FIELD UPON AMPLITUDE INCREASE OF ACOUSTIC WAVES IN A MEDIUM WITH DROPPING DENSITY [O VLIYANII MAGNITNOGO POLYA NA UVELICHENIYE AMPLITUDY AKUSTICHESKIKH VOLN V SREDE S PADAYUSHCHEY PLOTNOST'YU]
B. A. Tverskoy Jul. 1962 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk,SSSR, Geofiz. (Moscow), v. 144, no. 2, 1962 p 338–340
(NASA-TT-F-8266) CFSTI: HC $1.00/MF $0.50

Discussed is the acoustic wave propagation in a medium with density dropping to zero. The acceleration continues and is projected to greater amplitudes by the presence of a magnetic field and high conductance, and the characteristic length determining the limits of applicability of hydrodynamic equations is the ion Larmor radius. Considered is the case of an isothermal atmosphere in a homogeneous gravitational field where the magnetic pressure drops slowly, leading to an increase of the Alfvén velocity as the density drops, and consequently to an unlimited increase in the rate of magnetohydrodynamic energy tapping when the density approaches zero. It was concluded that chromospheric flares on the sun, taking place near the neutral points of the magnetic field, may be a consequence of cessation of wave acceleration with dropping density in the presence of a magnetic field. G.G.

N65-24178 Joint Publications Research Service, Washington, D. C.
ON THE STRUCTURE OF THE GROUND SURFACE OF OPTICAL GLASS
O. A. Sergeyev *In its* Izv. VUZov: Instr. Bldg., Vol. VIII, No. 1, 1965 17 May 1965 p 222–228 refs (See N65-24150 13-09)
CFSTI: $6.00

A statistical analysis is made of the structure of the ground surface of glass. The results are compared with data from other investigators. Formulas are obtained for calculating the average and maximum depths of the relief layer and the distribution function of the relief elements with respect to dimensions. Author

N65-24198# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
THE FOCUSING OF SOUND PROPAGATING VERTICALLY IN A HORIZONTALLY STRATIFIED MEDIUM
John W. Coffman Ft. Monmouth, N. J., Army Electron. Command, Apr. 1965 7 p ref
(ERDA-285; AD-461154)

An equation is developed for the spreading loss in the special case of sound energy propagating vertically in a medium where the speed of sound is a continuous function of the height only. The solution of this equation, in the case of a constant speed-of-sound gradient, includes a simple focusing term in addition to the usual square-law spreading term.
Author

N65-24245# Oak Ridge National Lab., Tenn. Physics Div.
PHYSICS DIVISION ANNUAL PROGRESS REPORT, PERIOD ENDING DECEMBER 31, 1964
J. L. Fowler and H. B. Willard May 1965 203 p refs
(Contract W-7405-ENG-26)
(ORNL-3778) CFSTI: $6.00

A progress report containing abstracts of papers which have been published or which have been prepared for publication, and preliminary results of continued research in theoretical and nuclear physics, is presented.
S.C.W.

N65-24320# Atomic Weapons Research Establishment, Aldermaston (England).
ELECTRON MICROSCOPY OF SODIUM CHLORIDE AEROSOL PARTICLES
E. E. Larner Oct. 1964 14 p refs
(AWRE-0-84/64)

Methods are described for the electron micrographic examination of sodium chloride aerosol particles that have been collected by several different sampling procedures. The methods are suitable for routine examinations in the particle range 7μ to 0.03μ and can be used with an electronic scanning counter.
Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N65-23431 National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.
THE STATE OF CARBON MONOXIDE ADSORBED ON A TUNGSTEN (211) SURFACE
R. A. Armstrong *In its* Bull. of the Radio and Elec. Engr. Div., Vol. 14, No. 4, Oct.–Dec. 1964 Dec. 1964 p 26–37 refs (See N65-23425 13-07)

Measurements of the change in surface potential of the tungsten (211) surface when covered with CO suggests that some of the CO exists as a complex containing two CO molecules and having zero dipole moment. The existence of a CO complex consisting of two CO molecules adsorbed as a pair was previously postulated to explain the observation that $C^{13}O^{16}$ and $C^{12}O^{18}$ mix isotopically to produce $C^{12}O^{16}$ and $C^{13}O^{18}$ in the presence of a tungsten filament heated to temperatures of 850° K and higher. The changes of surface potential of tungsten (100) and tungsten (211) crystal surfaces with the amount of CO gas which has struck the surface; the surface potential of CO covered W(211); and the effect of heating on the surface potential of tungsten in the presence of CO gas are discussed as indicating such a complex molecule for carbon monoxide adsorption on tungsten.
E.E.B.

N65-23545# Rochester Univ., N. Y. Dept. of Physics and Astronomy
MUON-PROTON SCATTERING AT HIGH MOMENTUM TRANSFERS
R. Ellsworth, A. Melissinos, J. H. Tinlot, R. Cool (Brookhaven Natl. Lab.), L. M. Lederman (Columbia Univ., New York) et al 25 Mar. 1965 16 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-77)

The result of an experiment to observe the scattering of muons by protons at high momentum transfers is reported. A comparison of the results with similar electron scattering data provides a sensitive test of any presumed difference in the charge structure of the leptons. The data consist of about 500 scattering events with momentum transfer in the interval 700 to 1100 MeV/c. They indicate no significant difference between μ-p and e-p scattering.
Author

N65-23598 European Organization for Nuclear Research, Geneva (Switzerland). Track Chamber Div.
BARYON RESONANCES
Robert D. Tripp 10 Feb. 1965 67 p refs Lectures presented at the Varenna Intern. School of Phys. on Strong Interactions, Jul. 1964
(CERN-65-7)

Most of the known baryon resonances of strangeness 0 and −1 can be formed directly by bombardment of a nucleon target by an appropriate meson beam. A detailed examination of angular distributions and polarizations as a function of energy for both elastic and reaction channels frequently reveals the existence of the resonance by observation of the characteristic energy dependence of the resonant scattering amplitude in the complex plane. In this series of lectures elementary scattering theory is used as an introduction to the subject. This was followed by a discussion of the Breit–Wigner equation, with particular emphasis on those aspects which are identified with scattering experiments. As a specific example of such an analysis, the $Y_0^*(1520)$ is discussed in detail since this is a multichannel resonance sufficiently complex to contain all aspects of the analysis. Finally, the other baryon resonances are surveyed with emphasis on those which have been discovered recently and for which quantum numbers are still uncertain.
E.E.B.

N65-23647# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica
π^+ PHOTOPRODUCTION ON PROTON THROUGH A PION-NEUTRON COINCIDENCE METHOD [MISURE DI FOTOPRODUZIONE DI MESONI π^+ MEDIANTE COINCIDENZE NEUTRON-PIONE]
M. Grandolfo 18 Nov. 1964 60 p refs In ITALIAN; ENGLISH summary
(ISS-64/41)

This report deals with π^+ photoproduction measured through a pion–neutron coincidence method. Pulse shape discrimination is used for neutron detection. Experimental results are discussed.
Author

N65-23649# Brookhaven National Lab., Upton, N. Y. Sigma Center

LEAST SQUARES ANALYSIS OF THE 2200 m/sec PARAMETERS OF U^{233}, U^{235}, AND Pu^{239}

Rudolph Sher and Joan Felberbaum Mar. 1965 13 p refs Sponsored by AEC

(BNL-918(T-377-92-94-2)) CFSTI: $1.00

Experimental values and calculated values of the 2200 m/sec cross sections of the principal fissionable isotopes U^{233}, U^{235}, and Pu^{239} are tabulated. With few exceptions the values calculated using the linearized equations of the least squares method agree with experimental values within listed uncertainties. The exception is the fission cross section for Pu^{239}, for which only a single measurement with a quoted uncertainty of 3.0% exists. E.E.B.

N65-23699# Stevens Inst. of Tech., Hoboken, N. J.

τ^+ ANALYSIS Annual Summary Report, Period Ending 30 Nov. 1963

T. Huetter, E. L. Koller, S. Taylor, P. Stamer, and J. Grauman [1964] 9 p refs Presented at the Am. Phys. Soc. meeting

(Contract Nonr-3066(00))

(SIT-P118(1/64); AD-430627)

An analysis of approximately 1000 $\tau^+ \rightarrow \pi^+ + \pi^+ + \pi^-$ events is presented. These events were found in an area scanning of an emulsion stack of 600μ Ilford G5 pellicles exposed to a 300-MeV/c separated K^+ beam. The energy spectra of the pions are compared to existing spectra of the secondaries from n, $\tau^\pm$ and τ'. Author

N65-23733# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France).

VARIATION OF THE MATRIX ELEMENTS OF THE HYDROGEN ATOM DIPOLE UNDER THE INFLUENCE OF A UNIFORM EXTERNAL ELECTRIC FIELD [VARIATION DES ELEMENTS DE MATRICE DU DIPOLE DE L'ATOME H SOUS L'INFLUENCE D'UN CHAMP ELECTRIQUE EXTERIEUR UNIFORME]

Hoe Nguyen, Eva Banerjea, Louis Herman (Lab. de Rech. Phys., France) and Hans-Werner Drawin 1965 40 p

(Contract EURATOM 007-62-1 FUAF)

(CEA-R-2544; EUR-1891.f) Available from Belgian Am. Bank and Trust Co., New York, Account No. 22.186: 50 Belg. Fr.

The quantum mechanical perturbation theory for the determination of the frequencies of the STARK components of hydrogen in a uniform external electric field, is to calculate the intensities of the line components. The numerical results show that the influence of the perturbing electric field is important also in higher orders. A theoretical justification of calculations, the equations used for the numerical calculations, and numerical results for the components of the first lines of the Lyman and Balmer series are presented. Author

N65-23740*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A NEW APPROACH TO THE HOMOGENIZATION OF HETEROGENEOUS MEDIA FOR NEUTRON DIFFUSION CALCULATIONS

Alan M. Jacobs 15 Apr. 1965 28 p refs

(Contract NAS7-100)

(NASA-CR-62712; JPL-TR-32-686) CFSTI: HC $2.00/MF $0.50

The mathematical formulation of a new approach to the homogenization of certain types of heterogeneous media (such as a regular array of holes in a scattering media) for the purpose of neutron diffusion calculations is developed. The new method is based on the inclusion of an angular-dependent mean free path in the theory of neutron transport. Calculations are restricted to media with plane symmetry and monoenergetic neutron theory is employed. It is found that a neutron-flux based theory and a collision-density based theory can lead to significantly different results when low-order approximations, such as diffusion theory, are employed in the solution of the transport equation. For the case of isotropic scattering, the normal mode technique is found applicable and closed-form, exact solutions are determined. There is little existing experimental work in the description of neutron distribution in such anisotropic media. It is therefore difficult to evaluate the results of the new theory. The interpretation of physical and numerical (Monte Carlo) experiments could be approached directly with the new techniques. Author

N65-23856# Bettis Atomic Power Lab., Pittsburgh, Pa.

RAM-1, A FORTRAN PROGRAM TO TRANSFORM AND AVERAGE CROSS SECTIONS FROM THE ROC LIBRARY TAPE FOR USE IN MULTIGROUP NEUTRON TRANSPORT PROGRAMS

D. R. Harris, C. B. Noll, and A. V. Vota Apr. 1965 32 p refs

(Contract AT(11-1)-GEN-14)

(WAPD-TM-501) CFSTI: $2.00

The RAM-1 is a Fortran program designed to aid in evaluation of neutron cross section data and in the preparation of cross-section decks for multigroup neutron transport programs. Cross-section data is retrieved from the ROC library tape, transformed if required, and averaged within arbitrary energy intervals as weighted by arbitrary neutron spectra. Transformed and/or averaged cross sections are edited or are used to prepare a cross-section deck as punched card input for the MILC program which prepares a cross section tape for the MUFT, P1MG and P3MG neutron transport programs. Author

N65-23864# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati

PHOTOPRODUCTION OF K^+ FROM COMPLEX NUCLEUS [FOTOPRODUZIONE DI K^+ DA NUCLEO COMPLESSO]

F. Knoke 26 Feb. 1965 17 p refs *Its* Nota Interna No. 272 In ITALIAN

(LNF-65/6)

Calculations for matrix elements of photoproduction resulting from the interaction of bremsstrahlung and the production of K-mesons are given. Also, the effect of optical potential on the density distribution of nucleon moments is discussed. The hypothesis for impulse approximation is used, taking into account the differential cross section of photoproduction caused by K-meson–nucleon interaction. Transl. by P.F.E.

N65-23865# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

RESONANT EXTRACTION FROM THE 1 GeV FRASCATI ELECTRON SYNCHROTRON

U. Bizzarri and A. Turrin 4 Mar. 1965 4 p refs Submitted for Publication *Its* Nota Interna No. 276

(LNF-65/10)

The extraction of the 1000-MeV electron beam by exciting the 2 radial betatron oscillations–3 revolutions resonance is discussed. Pulsed currents were fed at the end of the acceleration cycle into a few wires of the pole face windings, connected in a noninductive loop. The characteristics of the external beam were as follows: (1) 10^9 electrons/pulse or 2×10^{10} electrons/sec with an extraction efficiency of about 60%; (2) less than

10^{-2} cm rad in the horizontal and few 10^{-3} cm rad in the vertical at 1000-MeV beam emittance in air 5 meters from the exit window; (3) momentum spread within ±0.3% for spill-out times of about 2 msec. Also, spill-out times up to about 4 msec can be easily obtained. The gap's dimensions of the soft magnet were 20 mm by 11 mm^2 and the septum thickness was 1 mm. The hard magnet was like the soft one with the septum thickness increased to 6 mm for cooling purposes. The currents were: 30 A in the pole face windings; 550 A in the soft magnet; and 3500 in the hard magnet. E.E.B.

N65-23866# Hahn-Meitner-Institut für Kernforschung, Berlin (West Germany).
RARE GAS DIFFUSION IN SOLIDS [DIFFUSION VON EDELGASEN IN FESTKORPERN]
A. Brenner, F. Felix, T. Lagerwall, H. Migge, A. Richter et al Brussels, EURATOM, Jan. 1965 24 p refs In GERMAN; ENGLISH summary
(Contract EURATOM-094-62-9 RDD)
(EURAEC-1006; EUR-1729.d) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 40 Belg. Fr.

New mathematical methods for the evaluation of ideal postactivation diffusion are mentioned, and possible causes for nonideal release are discussed. Experimental results cover some apparative improvements and new results on the systems UO_2–Xe, UC–Xe, ThO_2–Xe, CaF_2–Ar, KCl–Ar, and AgLi–He with special regard to single crystals. Activation energies for the Xe^{133} diffusion were determined as follows in UO_2 single crystals, 70 kcal/mole between 1050° and 1760° C, in UO_2 sintered material, 53 kcal/mole between 800° and 1400° C, in ThO_2 crystals, 80 kcal/mole between 1200° and 2000° C. The gas-release from UC single crystals showed until now unexplainable deviations. The diffusion mechanism of Ar in CaF_2 single crystals has been revealed: in the intrinsic range (600° to 1300° C) an interstitial mechanism governs with an activation energy of 67 kcal/mole. In the extrinsic range one could show that no lattice diffusion, but probably a gas transport over dislocations with an activation energy of 8 kcal/mole, is predominating. The influence of the irradiation dose on the system CaF_2–Ar gives for high doses too low a diffusion coefficient, not being representative for the diffusion process.
Author

N65-23868# Fiat S.P.A., Turin (Italy). Sezione Energia Nucleare
FISSION GAS RELEASE FROM URANIUM DIOXIDE
I. Amato, G. Frigerio, and T. Gerevini 1965 58 p refs
(Contract EURATOM-021-60-9 RDI)
(EUR-1797.e; EURAEC-1126) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 85 Belg. Fr.

In 81 postirradiation annealing experiments to study fission gas retention capacity of UO_2 pellet specimens, selected from batches with four different UO_2 ceramic grade powders, were approximately 3.5 to 4 g in weight and were irradiated in the swimming pool reactor of SORIN at 5×10^{12} neutrons/cm^2/sec. Diffusion anneal duration for all experiments was 6 hr at a single constant temperature. For each type of pellet, irradiations with three different ranges of burnup to a maximum of approximately 700 $MWD/_{Te}$ were adopted. As exposure increases, apparent value of D' decreases between 10 and approximately 100 $MWD/_{Te}$. In this close range, the extent of this effect appears different in pellets of different origins. For exposures higher than 100 $MWD/_{Te}$, the decrease was much less important with a clear tendency to saturation and, in some cases, with an unexplained recovery of the D' decreases up to several times the lower value.
Author

N65-23886# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
A MASS FORMULA FOR THE BARYON MASS SPECTRUM
Charles L. Hammer and Thomas A. Weber Apr. 1965 21 p refs
(Contract W-7405-ENG-82)
(IS-1140) CFSTI: $1.00

A mass spectrum of the form $m^2 = M_l(M_l + |\alpha_l|)$ is derived, where α_l is the imaginary part of the l^{th} singularity in the complex energy plane of a T-matrix which describes the interaction of a particle of initial rest mass m with a potential V(x,t), where V(x,t) = 0 in the limit $|t| \to \infty$. This spectrum is found to give, within 1%, the mass of all baryons less than or equal to the mass of the Ω^- if m is taken as 1747 MeV and α_l is a small integral multiple of the K and π meson masses. Comparison to the Gell-Mann, Okubo formula relates these integers to the hypercharge and the isotopic spin. The analysis proposed by Lander is used to show that the results can have statistical significance.
Author

N65-23895 European Organization for Nuclear Research, Geneva (Switzerland).
STUDIES OF HIGH ENERGY NEUTRINO INTERACTIONS IN A HEAVY LIQUID BUBBLE CHAMBER [ETUDES D'INTERACTIONS DE NEUTRINOS DE GRANDE ENERGIE DANS UNE CHAMBRE A BULLES A LIQUIDE LOURD]
Michel Paty 5 Apr. 1965 124 p refs In FRENCH
(CERN-65-12)

A detailed analysis of events observed in a heavy-liquid bubble chamber exposed to an intense beam of high energy neutrinos obtained near the 25 GeV/c proton synchrotron is presented. The equivalent of 1 280 800 photos has been analyzed in a standard volume of 220 liters of freon CF_3Br (density = 1.5) and 447 interactions of neutrinos have been recognized. The equipment, the methods, and the provisions for exclusion of noise are described. A brief review of neutrino interaction theory includes the universal Fermi interaction, the conservation of weak vectorial current, and the calculation of the effective cross section of elastic interaction. Optically observed events are interpreted by (1) study of the elastic interaction and determination of the factor of axial form of the nucleon, (2) research for the hypothetical intermediate boson and determination of the lower limit of its mass, (3) discussion of the production of pions and strange particles by neutrinos, (4) establishment of the existence of two neutrinos and different laws of conservation, and (5) establishment of the upper limit and the contribution of neutral leptonic currents.
Transl. by M.P.G.

N65-23896# Instituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica
A SEARCH FOR TETRANEUTRONS PHOTOPRODUCED IN LIQUID HELIUM [RICERCA DI TETRA NEUTRONI FOTOPRODOTTI IN ELIO LIQUIDO]
U. Amaldi, Jr., G. Fronterotta, and G. Matthiae 30 Nov. 1964 11 p refs
(ISS-64/45)

In a search made of tetraneutrons photoproduced through the reaction $\gamma + {}^4He \rightarrow 2\pi^+ + {}^4n$, tetraneutrons are revealed by the reaction $^{27}Al(^4n, 2n)^{29}Al$. An aluminum block surrounds the liquid helium target and the production of ^{29}Al should show up through the successive emission of 2.43 MeV γ-rays. Since a γ-activity of this energy was not revealed, an upper limit was placed on the average production cross section: $\bar{\sigma} = (\leq 1.7 \pm 1.7)$ μb.
Author

N65-23935# Atomics International, Canoga Park, Calif.
AN INTRODUCTORY SURVEY OF THERMALIZATION THEORY FOR ZIRCONIUM HYDRIDE
W. J. Roberts 20 Apr. 1965 52 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-10899) CFSTI: $3.00

A brief introduction to the main features of the theory of thermal neutron scattering is presented; and the approaches, or models, used specifically for hydrides by various investigators are surveyed. Hydrogen models considered are (1) the rigid equilibrium point harmonic oscillator model, (2) its variant, the phonon model, and (3) the conduction-state, or periodic-potential wave-state model. Author

N65-23937# National Bureau of Standards, Washington, D. C.
PHYSICAL ASPECTS OF IRRADIATION. RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL UNITS AND MEASUREMENTS, 1962
A. V. Astin 31 Mar. 1964 116 p refs *Its* Handbook No. 85 (ICRU-10b) GPO: $0.70

This report deals with the physical aspects of irradiation. It includes discussion of the various techniques for the measurement of absorbed dose as well as exposure. Characteristics of radiation instrumentation are covered in detail, including work on standards. The section on spectra has been updated and a new section added on neutron measurements and standards. Available data for stopping power ratios and the average energy (W) required to produce an ion pair in a gas were reviewed. On the basis of this review, it was necessary to modify the previous ICRU tables for these factors. This modification amounts to about 1 or 2 percent change in stopping power ratios, and up to 1 percent in W. Author

N65-24069# European Atomic Energy Community, Brussels (Belgium).
OUTLINES OF THERMAL NEUTRONS SPECTRUM THEORY IN A NUCLEAR REACTOR [FONDAMENTI DELLA TEORIA DELLO SPETTRO DEI NEUTRONI TERMICI IN UN REATTORE NUCLEARE]
V. Ardente and G. Rossi Oct. 1964 98 p refs In ITALIAN; ENGLISH summary
(EUR-2108.i) Available from Belg. Am. Bank and Trust Co., New York, Account No. 22.186: 125 Belg. Fr.

After a general discussion of the energy-dependent transport equation, a basic introduction to the theory of scattering of thermal neutrons is given. Two typical space-dependent spectrum problems are discussed. Author

N65-24096# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
FOUR PARTICLE CORRELATIONS IN LIGHT NUCLEI
B. Bremond Mar. 1965 13 p refs
(TH-93)

It is proposed to use, for light nuclei, trial wave functions describing dynamically independent groups of four particles formed of two protons and two neutrons, each group being of the most general form. The usual methods of the pairing problem cannot be generalized to this case. A variational method adapted to this wave function is developed. Author

N65-24188# Naval Research Lab., Washington, D. C. Nuclear Reactions Branch
DETERMINATION OF THE SPIN AND PARITY OF NUCLEAR EXCITED STATES BY THE EXPERIMENTAL MEASUREMENT OF TRIPLE CORRELATIONS IN (p,γγ) REACTIONS
C. R. Gossett and L. S. August 12 Feb. 1965 93 p refs
(NRL-6186; AD-612508)

This report describes an experimental arrangement which allows the measurement of triple correlations with an exceptionally high efficiency and multiplicity (the capability of measuring many different correlations simultaneously). This improvement has been obtained primarily from the successful application of a three-crystal double sum-coincidence spectrometer. An explanation of the method and detailed descriptions of the physical apparatus, electronic circuitry, experimental procedures, and data analysis are given, including explanations of a number of deviations from normal in both the design and procedures. As an illustration of the effectiveness and limitations of the experimental arrangement, the results of an extensive triple correlation experiment on the $^{60}Ni(p,\gamma\gamma)^{61}Cu$ reaction are presented with the conclusions regarding the spin and probable parity of six of the lowest-lying energy levels, and a discussion of the applicability of certain nuclear models to this nucleus. Author

N65-24224# Rochester Univ., N. Y. Dept. of Physics and Astronomy
DOUBLE CHARGE EXCHANGE SCATTERING OF LOW ENERGY PIONS BY NUCLEI
D. S. Koltun and A. Reitan 6 Apr. 1965 16 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-80)

The double charge exchange cross section for the scattering of low energy pions by nuclei is calculated in second Born approximation, considering only s-wave scattering of the pions by individual nucleons. The differential cross section for pions of energy 20 to 40 MeV, and a light target with two neutrons outside a closed shell, is calculated to be $\sim 7\mu h/sr$, with considerable enhancement for targets with larger neutron excess. The scattering to the isobaric analog of the target ground state is strongly favored. Author

N65-24238# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
PHOTONEUTRON CROSS SECTIONS OF Pr^{141}, O^{16} AND C^{12}
John N. Bradford and Barnett C. Cook Feb. 1965 109 p refs
(Contract W-7405-ENG-82)
(IS-1086) CFSTI: $4.00

Cross sections for the (γ, n) reaction were determined from threshold to 65 MeV. Structure appears throughout most of the energy range in the O^{16} and C^{12} cross sections. The giant resonance is clearly split into several components in both cases. The Pr^{141} shows no resolved structure. Comparison is made with the predictions of the particle-hole model. Experimental details which enhance the validity of the results are emphasized. Author

N65-24243# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
PROPOSED DETERMINATION OF NUCLEAR FUEL BURNUP BASED ON THE RATIO OF TWO STABLE FISSION PRODUCTS OF THE SAME ELEMENT
William J. Maeck Apr. 1965 49 p refs
(Contract AT(10-1)-205)
(IDO-14642) CFSTI: $2.00

A new method is proposed for the determination of nuclear fuel burnup based on the ratio of selected pairs of two fission product nuclides of the same element. The ratios Kr^{83}/Kr^{84}, Xe^{131}/Xe^{132}, and Nd^{143}/Nd^{144}, which change with irradiation are useful as fission monitors. With this technique, many

problems associated with the conventional fission product analysis for burnup are eliminated. Author

N65-24244# Oak Ridge National Lab., Tenn. Radiation Shielding Information Center

A COMPARISON OF FIRST- AND LAST-FLIGHT EXPECTATION VALUES USED IN AN 05R MONTE CARLO CALCULATION OF NEUTRON DISTRIBUTIONS IN WATER

D. K. Trubey and M. B. Emmett May 1965 25 p refs (Contract W-7405-ENG-26)
(ORNL-RSIC-3)

The distributions in water of fast neutrons from isotropic fission and 14-MeV point sources were calculated with the 05R Code. Two methods of scoring the same case histories were used to estimate the energy distribution and the dose rate. The estimators employed were the first- and last-flight expectation, or statistical estimation, values. The first-flight estimator was found to be somewhat better due to the importance of the first flight in the total transport of the neutrons. The results are in good agreement with RENUPAK moments method results and with experimental results. Author

N65-24260# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science

PARTICLE-HOLE SCATTERING SYSTEMS

C. A. Caine and R. H. Lemmer Nov. 1964 14 p (Contract AT(30-1)-2098-113)
(TR-78)

A theoretical study of the scattering of a low energy nucleon by a nucleus which in the simple shell model is represented by a single hole, such as N^{15}, is presented. The methodology involves expansion of a scattering wave function in terms of antisymmetric states of the target nucleus. To investigate inelastic scattering as well as gamma-n and gamma-p reactions on O^{16}, coupled differential equations for the amplitudes are derived. In an appendix the explicit form of the coupled equations is presented with the boundary conditions imposed on their numerical solutions. A computer program is being composed for the numerical calculations; the input variables for this program are identified. J.M.D.

N65-24281# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.

MASS TRANSPORT AND GRAIN GROWTH BY FISSION FRAGMENTS IN THIN FILMS OF URANIUM OXIDE

M. D. Rogers Jan. 1965 15 p refs
(AERE-R-4793)

When fission fragments leave the surface of vacuum-deposited uranium dioxide both the rate of ejection of atoms and the nature of material collected differ considerably from those observed using solid uranium metal. The differences are explained in terms of thermal rods, vaporization and grain growth as opposed to displacement spikes, ejection of discrete particles and dynamic equilibrium for uranium metal. Author

N65-24283# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

CHARGED SCALAR THEORY AND BROKEN CHARGE SYMMETRY

Howard J. Schnitzer Apr. 1965 6 p refs
(Th.-94)

The symmetry breakdown of static charged scalar meson theory is examined with the principle result being that static charged scalar theory cannot undergo spontaneous symmetry breakdown. Any breakdown must already be present in the bare Hamiltonian, with, e.g., unequal neutron and proton bare masses. Thus the scattering solutions do not exhibit less symmetry than the Hamiltonian, as would be the case for spontaneous breakdown. The argument is given only for the elastic unitarity approximation, but once this is assumed an exact relation can be given between the bound state (isobar) mass difference and the neutron–proton physical mass difference without a perturbation expansion in the symmetry breaking terms. Author

N65-24288# General Electric Co., Philadelphia, Pa. Space Sciences Lab.

THE VELOCITY DEPENDENT NON-LTE LINE SOURCE FUNCTION

J. L. Kulander May 1965 61 p refs
(R65SD12)

The non-LTE line source function is determined in a plane-parallel semi-infinite atmosphere in which there is an ordered macroscopic motion which is a discontinuous function of depth. A two-layer model atmosphere containing different uniform ordered velocities in each layer is considered. A constant temperature and a two-level atomic model are assumed. The depth and magnitude of the velocity discontinuity are varied along with photon diffusion length and amount of continuous opacity. Solutions for the emergent line intensity are compared with those obtained by various limiting forms of the static two-layer atmosphere source function. Author

N65-24289# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

INTERNAL ENERGY OF REACTION PRODUCTS BY VELOCITY ANALYSIS. II: SCATTERED KBr FROM THE CROSSED MOLECULAR BEAM REACTION K + Br_2

Arthur E. Grosser and Richard B. Bernstein 1 Apr. 1965 21 p refs Sponsored by AEC
(WIS-TCI-88X; COO-1328-14)

The velocity distribution of excited KBr formed in reactive collision between crossed beams of velocity-selected K and thermal Br_2 was measured at several laboratory scattering angles and initial relative kinetic energies of 1.26, 2.14, and 3.27 kcal/mole. From these observations qualitative information may be inferred regarding the internal energy distribution function and the angular distribution of reactive scattering in the center of mass (c.m.) system. It is found that (1) most of the 46 kcal/mole exothermicity of the reaction appears in the form of internal excitation of KBr; (2) the internal energy distribution is broad, extending over a range of at least 30 kcal/mole; and (3) the angular distribution of reactive scattering in the forward direction (KBr preferring the direction of the incident K in the c.m. system), is characterized by a cone in the c.m. with an angle of generation of at least 30°. Author

N65-24295*# Philco Corp., Blue Bell, Pa. Applied Research Lab.

RADIATION-RESISTANT DEVICE PHENOMENA

William C. Follmer and Walter M. Kane Feb. 1965 39 p (Contract NASw-997)
(NASA-CR-62822) CFSTI: HC $2.00/MF $0.50

The facilities required for controlled production of reactively evaporated aluminum-oxide films are complete and a number of controlled deposition runs have been made. Highly insulating aluminum-oxide films ranging in thickness from 10 to 40 μgm cm^{-2} were prepared. The yield has been consistently high, even for the thinnest samples. These films exhibit a time variation in their electrical properties while being stored in a dry-nitrogen ambient. Upon exposure to atmosphere, there is a transient decrease in film impedance.

At the present time this is thought to be due to the effects of atmospheric water vapor. Author

N65-24319# Atomic Weapons Research Establishment, Aldermaston (England).
DICE MK IV: THE PREPARATION OF NUCLEAR DATA INTO A FORM SUITABLE FOR MONTE CARLO CALCULATIONS USING THE IBM 7030 COMPUTER
W. M. M. Kerr Dec. 1964 47 p refs
(AWRE-0-81/64)

DICE Mk.IV, which is described in this report, is a system which automatically converts basic nuclear data into a form suitable for Monte Carlo calculations. Its constituent components MOULD, ABSYNTH, EGMV, and CR are separately described. Author

N65-24385*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science
NEUTRON CROSS SECTIONS FOR U^{238}
G. D. Joanou and C. A. Stevens 16 Apr. 1965 23 p refs (Contract SNPC-27)
(NASA-CR-54290, Rev.; GA-6087, Rev.) CFSTI: HC $1.00/MF $0.50

This revised set of neutron cross sections for U^{238} contains (1) tables for possible neutron reactions with U^{238} in the energy range 0.001 eV to 15.0 MeV; (2) U^{238} resonance parameters ranging from 6.68 eV to 3904.4 eV; (3) a comparison of calculated values and values from empirical formulas for the resonance integrals of UO_2; (4) low-energy cross sections for U^{238} computed from the resonance parameters at the 101 energy points required for the Gather II computer program; (5) neutron cross sections of U^{238} from 0.01 Mev to 15.0 MeV; (6) partial inelastic cross sections for U^{238}; and (7) the Legendre expansion coefficients for U^{238}. G.G.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N65-23508 Joint Publications Research Service, Washington, D. C.
AN EXPERIMENTAL INVESTIGATION OF SHOCK WAVES INDUCED BY AN IMPULSE CURRENT IN A RAREFIED GAS
O. A. Malkin, V. N. Grigor'yev, and A. F. Vitshas *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 99–110 refs (See N65-23500 13-01) CFSTI: $6.00

The model of the motion of a slug of plasma in a vacuum between two electrodes under the action of the self-magnetic field was first proposed by Artsimovich. For high initial pressures the motion of the plasma was regarded as a shock wave arising ahead of the current sheet which plays the role of a piston. However, these models gave a poor explanation of the results obtained in tests at both low pressures (10^{-4} to 10^{-6} mm Hg) and pressures from 10^{-2} to several mm Hg. It was stated that the plasma slug actually has a complex structure and consists of two plasmoids traveling at differing velocities. On the other hand, at high pressures experiments have shown that the leading front of the current sheet coincides with the leading front of the illumination. It is believed that there is no shock wave ahead of the current sheet as it moves between the electrodes. A mechanism for the acceleration of a plasma with the aid of a double electrical sheet was proposed. The experiments confirmed the existence of the double sheet. An investigation was made of the motion of a plasma between two plane parallel electrodes over a wide range of pressures for the purpose of verification of the applicability of the theories mentioned above. Author

N65-23593# Aracon Geophysics Co., Concord, Mass.
THE PENETRATION OF OBLIQUE HYDROMAGNETIC WAVES THROUGH HORIZONTALLY STRATIFIED PLASMA AND UN-IONIZED MEDIA, WITH APPLICATIONS TO THE LOWER IONOSPHERE, VOLUME I Final Report
Robert F. Smiley Jun. 1964 190 p refs *Its* Rept.-13
(Contract DA-36-039-SC-89177; ARPA Order 163)
(ARA-T-9197-13; AD-461698)

Interaction of hydromagnetic and electromagnetic waves at an abrupt interface between a collision-free plasma and a vacuum is considered, with particular regard to interactions of Alfvén and modified Alfvén waves. Modification to that study produced by introducing a perfectly conducting plane in the vacuum is then studied. A third study is concerned with evaluation of the magnetic field at the surface of the earth and the corresponding reflected hydromagnetic waves produced by descending oblique hydromagnetic waves in the ionosphere. This study considers the ionosphere a horizontally stratified partially ionized plasma characterized by a tensor conductivity. Extensive numerical results were obtained for wave frequencies of 0.35 and 1.00 cps for four extreme ionosphere conditions. Two other studies deal with the propagation of hydromagnetic waves in the lower and upper regions of the F-layer of the ionosphere. Author

N65-23603# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
FLOW EQUATIONS FOR A CHEMICALLY REACTING PLASMA
Richard B. Thomas, Jr. Apr. 1965 45 p
(R65SD7)

The theoretical basis for the treatment of the broad class of fluid dynamic problems involving the flow of a chemically reacting gas is developed. Emphasis is on general principles; no attempt is made to give a complete account of all possible interactions in such complex systems. The mechanics of the collision process are, however, given special consideration. Approximations generally used are stated and explained. The Boltzmann equation is derived and some elementary solutions are obtained. The results are used to obtain the conservations laws, etc. Author

N65-23643# Colorado Univ., Boulder. Joint Inst. for Lab. Astrophysics
RESEARCH PROGRAM IN PHYSICS AND ASTROPHYSICS: ASTROPHYSICS, PLASMA PHYSICS, AERODYNAMICS, NUCLEAR PHYSICS AND SPECTROSCOPY, 1 OCTOBER–31 DECEMBER 1964
Lewis M. Branscomb 8 Feb. 1965 17 p refs
(Contract DA-31-124-ARO(D)-139; ARPA Order 492)
(AD-610847) CFSTI: HC $1.00/MF $0.50

Some results and project activities are reported on studies in plasma statistics, aerodynamics, atomic collisions, atomic resonance, ultraviolet spectroscopy, and reaction rates, which are intended for application to astrophysical problems. J.M.D.

N65-23748# ARACON Geophysics Co., Concord, Mass.
TRANSMISSION OF VERTICALLY INCIDENT PLANE HYDROMAGNETIC WAVES THROUGH A HORIZONTALLY STRATIFIED COLLISION-FREE PLASMA, VOLUME II Final Report
Robert F. Smiley Jun. 1964 70 p refs *Its* Rept.-13
(Contract DA-36-039-SC-89177; ARPA Order 163)
(ARA-T-9197-14; AD-461699)

A theoretical study is performed of the penetration of low-frequency vertically incident plane hydromagnetic waves through a horizontally stratified collision-free plasma, permeated by a constant external magnetic field. For a vertical external magnetic field, analytic expressions are obtained for transmitted and reflected wave properties for waves proceeding through a plasma with exponentially decreasing density into a vacuum final region. For an inclined external magnetic field and frequencies small compared with the ion cyclotron frequency, the modified Alfvén mode of wave propagation has reflection and transmission properties of the same type as for a vertical external magnetic field. Author

N65-23821*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EQUILIBRIUM COMPUTATIONS FOR MULTICOMPONENT PLASMAS
Frank J. Zeleznik and Sanford Gordon Washington, NASA, May 1965 27 p refs
(NASA-TN-D-2806) CFSTI: HC $1.00/MF $0.50

A method presented for the calculation of multicomponent plasma properties includes both Debye–Hückel and ionization potential lowering effects. These effects are shown to be partially compensating. A perturbation technique is used to make the calculation compatible with a scheme used for calculating ideal gas properties. Thermodynamic derivatives, such as heat capacity, can be calculated directly. Author

N65-23848# California Univ., La Jolla. Dept. of Physics
KINETIC THEORY OF PARTICLES AND WAVES
Norman Rostoker [1965] 2 p refs Sponsored by AEC and ARPA

The classical many-body problem is discussed in terms of a cluster expansion, ordered by particle discreteness or mode-coupling. Perturbation of the problem appropriate to a test charge leads to a general definition of a quasi-particle which is the test charge, and its associated shield cloud. If the calculation is carried to the next order of the expansion parameter, the new feature of quasi-doublet emerges defined by perturbing the problem with two test charges. The formal expression of these concepts is developed into a systematic calculation procedure. This method was used to determine three-body correlations for a stable plasma, and was applied to an unstable plasma where the emphasis is on waves. G.G.

N65-23861# Nagoya Univ. (Japan). Inst. of Plasma Physics
PROPAGATION OF HYDROMAGNETIC WAVES IN COLLISIONLESS PLASMA II
Yusuke Kato, (Kobe Univ.) Masayoshi Tajiri, (Univ. of Osaka) and Tosiya Taniuti Sep. 1964 24 p refs
(IPPJ-30)

The propagation of a hydromagnetic wave diverging from a point source is investigated graphically, as well as analytically, for a collisionless plasma. The general theory of steady flows is given, and a detailed discussion presented for the two-dimensional alined field-flow in which the directions of magnetic field and flow are alined everywhere. All the discussions are based on the C-G-L approximation. Author

N65-23862# Nagoya Univ. (Japan). Inst. of Plasma Physics
ELECTROMAGNETIC SHOCK WAVE IN A TRANSPARENT MEDIUM
Kazunari Ikuta and Tosiya Taniuti Nov. 1964 13 p refs
(IPPJ-31)

Electromagnetic wave propagation in a simple model of a dielectric medium characterized by a nonlinear relation between the electric displacement and the electric field strength is considered. The formation of shock-like discontinuity is shown by the method of characteristics, and jump relations are derived across such a discontinuity corresponding to the Rankine–Hugoniot relation in gas dynamics. That the evolutionary condition enables selection of a physically relevant solution among others admissible by the jump relations is shown. Author

N65-23943# Microwave Associates, Inc., Burlington, Mass.
INVESTIGATION OF HIGH POWER GASEOUS ELECTRONICS Fourth Quarterly Progress Report, 16 Aug.–15 Nov. 1963
H. S. Maddix, J. Gregory, and C. S. Ward [1963] 32 p refs
(Contract DA-36-039-AMC-00097(E))
(Rept.-4; AD-431041)

Cleanup and thermal recovery of inert gases at the interface between a high-power microwave discharge and a quartz surface were investigated. Using representative gas samples, the square root cleanup rate was found independent of fill pressures in the 0.5 to 5-torr range. The square root cleanup rate was observed to increase linearly with the square root of the incident peak power. Neon was found to have an activation energy of 11.3 kcal/mole for diffusion in quartz. Author

N65-24012# Kernforschungsanlage Juelich (West Germany). Zentralbibliothek
CHRONOLOGICAL BIBLIOGRAPHY OF MHD EXPERIMENTS WITH LIQUID METALS AND ELECTROLITES [CHRONOLOGISCHE BIBLIOGRAPHIE DER MHD-EXPERIMENTE MIT FLUSSIGEN METALLEN UND ELEKTROLYTEN]
H. A. Claassen Jun. 1964 18 p refs In GERMAN
(Jül-Bibl.-6)

N65-24142# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
INTERACTION BETWEEN MICROWAVES AND PLASMAS IN GAS DISCHARGES AND SEMICONDUCTORS Final Scientific Report 1965
B. Agdur 31 Mar. 1965 154 p refs
(Contract AF 61(052)-796)
(RADC-TR-173; AD-614654)

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7. AN EXPERIMENTAL INVESTIGATION OF COUPLING TO SLOW WAVES IN PLASMA WAVEGUIDES B. Enander p 121–128 refs (See N65-24148 13-25)

8. AN EXPERIMENT ON HELICON WAVES IN InSb F. Lindvall p 129–148 refs (See N65-24149 13-26)

N65-24143 Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.

WAVE PROPAGATION IN A PARALLEL-PLATE WAVEGUIDE PARTIALLY FILLED WITH A HOT AND INHOMOGENEOUS PLASMA

P. Hedvall *In its* Interaction Between Microwaves and Plasmas in Gas Discharges and Semicond. 31 Mar. 1965 p 48–65 refs (See N65-24142 13-25)

Dispersion equations of TM waves in a parallel-plate waveguide partially filled with a hot and inhomogeneous plasma slab, are derived and numerically solved. Three types of modes exist: the plasma modes, which do exist even with a cold and homogeneous plasma; the electrostatic modes; and the perturbed waveguide modes. All modes have a phase velocity greater than the mean thermal velocity of the plasma electrons. Author

N65-24144 Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.

THE INFLUENCE OF COLLISIONS ON WHISTLER PROPAGATION

P. Hedvall and L. Sjögren *In its* Interaction between Microwaves and Plasmas in Gas Discharges and Semicond. 31 Mar. 1965 p 66–76 refs (See N65-24142 13-25)

The dispersion characteristics of whistler waves propagating along a longitudinally magnetized and lossy plasma slab are numerically calculated. It is shown that if the wavelength of the whistler waves is much smaller than the transverse dimensions of the plasma slab then a nonzero collision frequency can have a large influence on the dispersion characteristics. For such small wavelengths one should expect the whistler dispersion to be close to that of the corresponding plane waves but this is for certain parameter values, true only if the collision frequency is assumed to be nonzero. Author

N65-24145 Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.

EXPERIMENTS ON PLASMA MICROWAVE INTERACTION

B. Kerzar and P. Weissglas *In its* Interaction between Microwaves and Plasmas in Gas Discharges and Semicond. 31 Mar. 1965 p 77–101 refs (See N65-24142 13-25)

Transmission characteristics of a rectangular waveguide with a perpendicularly inserted mercury-vapor discharge tube were measured. The waveguide was excited in the TE_{01} mode, and the plasma column was either perpendicular or parallel to the electric vector of the waveguide mode. To explain the results, dispersion curves were measured for the symmetric, dipole, and quadrupole modes propagating on the plasma cylinder. In addition, the dispersion curve for a new symmetric mode was measured. This mode is of the same nature as the fast dipole modes responsible for subsidiary Tonks–Dattner resonances. It was proved how various peaks in the transmission spectrum are caused by coupling to plasma waves. In particular, the small previously unexplained peaks are due to coupling to slow plasma waves as was also proved by direct measurement of the slow waves leaking out through the holes in the waveguide. Author

N65-24146 Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.

ION WAVES ON BOUNDED PLASMAS

B. Andersson and P. Weissglas *In its* Interaction between Microwaves and Plasmas in Gas Discharges and Semicond. 31 Mar. 1965 p 102–112 refs (See N65-24142 13-25)

Ion acoustic waves propagating along a cylindrical plasma column are studied theoretically. By neglecting the ion temperature, a simple boundary condition at the plasma surface can be derived. In addition to the infinite number of ion wave modes which degenerate into purely longitudinal waves in an infinite plasma, there exists a surface mode which is the ion equivalent of the electron surface mode of Gould and Trivelpiece. It is also shown that due to interaction between the ion modes and the Gould and Trivelpiece mode the dispersion curves of the ion waves are strongly modified. Author

N65-24147 Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.

DETERMINATION OF ELECTRON DRIFT VELOCITY IN A GASEOUS DISCHARGE FROM DOPPLER SHIFTS OF PLASMA WAVES

B. Kerzar and P. Weissglas *In its* Interaction between Microwaves and Plasmas in Gas Discharges and Semicond. 31 Mar. 1965 p 113–120 refs (See N65-24142 13-25)

The electron drift velocity in the positive column of a low-pressure mercury discharge was estimated from measurements of Doppler shifts of plasma waves propagating along the discharge column. The purpose of this experiment was to gain information on the possible variation of the electron drift velocity over the discharge cross section. Therefore two modes of wave propagation with drastically different radial field configurations were used. One mode had its fields confined to a very thin layer at the plasma boundary and the other mode had fields which were approximately constant across the plasma tube. The electron drift velocity obtained from these two modes agreed with each other within experimental error and also agreed with the drift velocity obtained from measurements of current and electron density. It is therefore concluded that the electron drift velocity in the low-pressure mercury vapor discharge is approximately constant in the radial direction. Author

N65-24148 Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.

AN EXPERIMENTAL INVESTIGATION OF COUPLING TO SLOW WAVES IN PLASMA WAVEGUIDES

B. Enander *In its* Interaction Between Microwaves and Plasmas in Gas Discharges and Semicond. 31 Mar. 1965 p 121–128 refs (See N65-24142 13-25)

The properties of different kinds of junctions between a coaxial line and a plasma waveguide have been investigated experimentally in the microwave region. Only circularly symmetric modes were excited, and conditions were such that only the two dominant modes could propagate. The results show that it is possible to obtain a good match between the two waveguides by using a tapered inner conductor in the coaxial line. Author

N65-24189# Advanced Kinetics, Inc., Costa Mesa, Calif.

PLASMA KINETIC ENERGY—RF CONVERSION Final Report

R. W. Waniek, R. T. Grannan, D. G. Swanson, J. Nickel, J. E. Witsken et al Griffiss AFB, N. Y., RADC, Feb. 1965 124 p refs (Contract AF 30(602)-2981) (RADC-TR-64-550; AD-614285)

The results of a theoretical and experimental study of possible methods for the conversion of plasma kinetic energy into electromagnetic radiation are reported. The emission by the plasma of unprecedented amounts of microwave power both at X- and K-band was detected. The figures have increased from an initial 50 mW to nearly 500 W at X-band after optimization of some of the variable parameters. The appropriate theoretical framework is established with a discussion of runaway electrons in a plasma which contribute to the generation of strong collective effects; a model is proposed. The dependence upon various parameters of the microwave emission at X- and K-band is discussed, together with the detection of high energy photons attributed to the impingement of the accelerated electrons against the walls of the container. The microwave power detected is critically discussed in terms of particle and orbit parameters, and the assumption of at least partial coherence appears inescapable. Author

N65-24269 Aeronautical Research Council (Gt. Brit.)
A SIMPLE METHOD OF CALCULATING THE FLOW PRODUCED IN AN ANNULAR ELECTRIC ARC HEATER
J. M. Shaw London, HMSO, 1965 27 p refs Supersedes RAE-TN-AERO-2922, ARC-25692; see X64-12379
(ARC-CP-779; RAE-TN-AERO-2922; ARC-25692) HMSO: 5s 6d

A simple model is described from which the flow in an annular electric arc heater can be calculated. It is intended to clarify ideas about such heaters, to direct thought to alternative, possibly better, types and to guide experimental work. When more experimental and theoretical results are available it can form the basis from which heaters might be designed. It is shown that the simple annular type of heater will probably produce excessive swirl in the outlet airstream. Alternatives are suggested. Account is taken in the theory of both the heat addition and the forces produced by the interaction of magnetic fields with the arc current. Author

N65-24277 United Kingdom Atomic Energy Authority, Harwell (England). Applied Physics Div.
LOW-VOLTAGE DIFFUSED DISCHARGE IN ATMOSPHERIC-PRESSURE ARGON WITH SMALL ADDITIONS OF POTASSIUM
H. I. Ellington Feb. 1965 32 p refs
(AERE-M-1545)

Properties are described of a low-voltage, high-current electric discharge in atmospheric-pressure argon containing a small quantity of potassium vapor as seed. The apparatus used is also described. The existence of two distinct modes of the discharge, one with a diffused cathode glow, the other with a constricted cathode arc spot, is discussed; conditions for the stability of the diffused mode are given. A description of the apparent structure of this diffused discharge is given, and the variation of its properties with total current, potassium pressure, and temperature described. A theoretical explanation of the variation of positive column field with current is given. The existence of an optimum seed pressure is demonstrated. The dependence of the breakdown voltage of the gas on electrode spacing, temperature, and potassium pressure is discussed. Author

N65-24376*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A TECHNIQUE FOR OBTAINING PLASMA-SHEATH CONFIGURATIONS AND ION OPTICS FOR AN ELECTRON-BOMBARDMENT ION THRUSTOR
Eugene V. Pawlik, Paul M. Margosian, and John F. Staggs Washington, NASA, May 1965 34 p refs
(NASA-TN-D-2804) CFSTI: HC $2.00/MF $0.50

A technique was developed for determining the location of the plasma boundaries and the ion trajectories for the accelerator system of an electron-bombardment ion thrustor. The technique consists of using an electrolytic tank and an analog computer to solve Poisson's equation within the region between the ion-chamber and exhaust-beam plasmas with known initial and final plasma potentials. The boundary of the ion-chamber plasma serves as an emitter from which a specified ion current is extracted. The process of matching the boundary conditions, solving Poisson's equation, and finding the ion trajectories is a convergent iterative procedure. Four two-dimensional cases, representing a range of electrical parameters and ion flows for a fixed accelerator grid geometry, were solved. High direct impingement was found at high ion flow conditions. Charge-exchange ion focusing toward the region between the holes or the downstream accelerator surface is evident in the solutions. In addition to comparing predicted trends with experimental data, the accuracy of the solutions was checked with a digital computer program, where the plasma boundary determined by the analog technique was used as a fixed emitter. A comparison between the two-dimensional solutions obtained and the axisymmetric situation encountered in actual thrustors was obtained through the use of a digital program. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N65-23436 Library of Congress, Washington, D. C. Aerospace Technology Div..
GROWING YTTRIUM AND RARE EARTH ELEMENT–IRON GARNET CRYSTALS
John Kourilo *In its* Foreign Sci. Bull., Vol. 1, No. 5 May 1965 p 24–29 refs (See N65-23432 13-34)

An analysis of Soviet research for the period 1959 through 1964 indicates a planned and coordinated effort to grow pure and structurally perfect single crystals, and to study their morphology, structure, and electromagnetic properties. A technique was introduced for crystallization from a fluxed melt on a seed (thin monocrystalline surface layer); and a correlation was discovered between the morphology and structure of the crystals and the ionic radii of the elements of the third subgroup of the periodic system, and the chemical composition of the oxide-components of the iron garnet crystals. Author

N65-23493 Texas Univ., Austin. Quantum Electronics Research Lab.
THERMAL PINCHING AT LOW FIELDS IN n-TYPE GERMANIUM
David K. Ferry and Arwin A. Dougal *In its* Quantum Aspects of Elec. Sci. 1 Oct. 1964 p 26–33 refs (See N65-23491 13-16)

Germanium samples were pulsed with essentially rectangular current pulses obtained by discharging a coaxial transmission line. The pulse length was varied from 0.30 to 0.95 microsec. The Ge was cooled to 77° K, and a pulse repetition rate of

less than 10/sec was used to reduce residual heating. Thermal breakdown was characterized by a decrease in the voltage across the sample. Oscilloscope traces of the voltage and current illustrate the effect of thermal breakdown. The effect of the thermal pinch is evident from a plot of electric field vs. current density. Thermal breakdown was observed when the electric power input exceeded a threshold level. This threshold power level is related to the thermal heat flow in the semiconductor. The ohmic curve for the samples illustrates extreme deviation from ohmic behavior which occurs with thermal breakdown. The region of incremental negative resistance is clearly evident from the curves. Also, the effect of magnetic fields on the thermal pinch is illustrated. E.E.B.

N65-23496 Texas Univ., Austin. Quantum Electronics Research Lab.
A TIME RESOLVED STUDY OF SECOND BREAKDOWN IN SILICON SWITCHING TRANSISTORS
David K. Ferry and Arwin A. Dougal *In its* Quantum Aspects of Elec. Sci. 1 Oct. 1964 p 76–83 refs (See N65-23491 13-16)

Silicon switching transistors were used in the study of characteristics involved with second breakdown. The transistors were pulsed by discharging a coaxial transmission line. The pulse width was variable up to 1.0 microsec with a variable amplitude to 2 kV. The time delay was measured from the oscillograms of the voltage and current. The occurrence of second breakdown at room temperature in the open emitter mode nearly always results in the destruction of the transistor. For this reason operation at liquid nitrogen temperatures was also used since this tends to prolong the lifetime in this particular mode. The study of the occurrence of second breakdown emphasized that it is basically a single junction phenomenon, although it is feasible that the occurrence is not dependent upon the presence of the junction as such but rather appears as a result of the high fields existing under conditions of reverse bias. E.E.B.

N65-23590# General Dynamics/Electronics, Rochester, N. Y.
THEORY OF THE OPTICAL PROPERTIES OF THIN POLYCRYSTALLINE METAL LAYERS Technical Documentary Report, Jun. 1962–Jul. 1963
Carl E. Drumheller Wright-Patterson AFB, Ohio, AF Avionics Lab., Dec. 1964 12 p refs
(Contract AF 33(657)-8753)
(ASD-TDR-63-519, Pt. III; AD-461605)

By considering the polycrystalline structure of thin metal layers, reactive as well as resistive components of the sheet impedance can be identified and related to the optical properties. In the cases studied, the reactance has been identified with the intergrain capacitance and has been related simply to the geometry of the film structure. A final link between the optical properties and the film structure has been achieved with the derivation of an equation by which the grain boundary resistance can be calculated from the basic electronic properties of the material. Author

N65-23675*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL STUDY OF EVAPORATED $BaTiO_3$ FILMS
Eiji Sekine and Hiroo Toyoda May 1965 31 p refs Transl. into ENGLISH from J. Vacuum Soc. Japan (Japan), v. 5, no. 8, 1962 p 310–322 Presented at the Joint Gen. Meeting of Appl. Phys., Mar. 31, 1962
(NASA-TT-F-9333) CFSTI: HC $2.00/MF $0.50

The films of $BaTiO_3$ and (Ba-Sr) TiO_3 were prepared with two types of evaporating methods. Several kinds of materials were used as substrates, and their temperatures ranged from 200° C. The films were baked at various temperatures in air or O_2. The crystallization was investigated by means of X-ray diffraction and electromicroscope. For platinum substrate, the crystallization was not appreciable for the substrate temperatures and also baking temperature, up to 400° C; above 400° C, the crystalline size increased with the rise of temperature. The films, as they were evaporated, had low specific resistance and low dielectric constant, and baking them brought about an increase in these two values. A TiO_3 film, thus baked at 1200° C, had a dielectric constant about 1500 at room temperature, and dielectric anomalies were observed at the temperatures 100°, 0°, and −80° C. Author

N65-23707*# Martin Co., Orlando, Fla. Physical Sciences Lab.
INVESTIGATION OF THE PROPAGATION OF MILLIMETER AND SUBMILLIMETER WAVES Monthly Letter Report, 1–31 Oct. 1964
Vernon E. Derr 4 Nov. 1964 1 p
(Contract NASw-963)
(NASA-CR-62672) CFSTI: HC $1.00/MF $0.50

Experimental work continued with the Fabry–Perot interferometers and techniques of Q measurements refined to allow more accurate attenuation measurements. However, the low Q-value of the existing interferometers will not allow attenuation measurements for off-resonant absorption. A new interferometer was designed for this purpose. It is a semiconfocal design with plates 8 inches in diameter, separated by 18 inches. A Q-value between 10^5 to 10^6 is expected. Further, a previously unobserved water absorption line at a harmonic of 74.6668 gc was found. A computer program to obtain more accurate molecular constants is anticipated as soon as sufficient lines are observed. This would allow the remaining lines to be located more easily. A major problem reported is the harmonic generation from the carcinotron. A second harmonic has not yet been surely propagated down a waveguide; the difficulty is probably due to moding in an oversized waveguide, reducing the energy density on the nonlinear element. E.E.B.

N65-23728# Clevite Corp., Cleveland, Ohio. Electronic Research Div.
RESEARCH INTO NEW APPROACHES FOR VHF FILTER CRYSTALS Quarterly Report, 1 Aug.–31 Oct. 1963
D. R. Curran and D. J. Koneval 26 Nov. 1963 47 p refs
(Contract DA-36-039-AMC-0224(E))
(QR-2; AD-430492)

Trapped-energy mode theory predicts the existence of inharmonic overtone modes whose resonant frequencies are dependent both on electrode dimensions and on the difference in resonant frequency between the electroded and surrounding regions of an AT-cut quartz wafer. Trapped-energy mode theory also predicts that these modes can have observable responses only when mode resonance occurs below the wafer cutoff frequency. Both predictions were confirmed for measurements on wafers with rectangular electrodes alined in the Z direction. Initial measurements on multielectroded resonators indicate that individual dot resonators can be electrically connected in parallel to form on one wafer in effect a single large resonator with a strong clean response. Experiments with AT-cut mesa resonators indicate that higher values of Q_m can be obtained with larger resonant frequency differences between the mesa region and the surrounding regions of the wafer. However, satisfactory methods for fabricating mesa resonators have not yet been developed. Author

N65-23761# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABOUT A POSSIBLE EXPLANATION OF PHENOMENA IN PHOTOELECTRETS BY MEANS OF PHOTODIPOLE POLARIZATION OF THE LATTER

A. Antonov 20 Jan. 1965 14 p refs Transl. into ENGLISH from Compt. Rend. Acad. Bulgare Sci. (Sofia), v. 15, no. 5, 1962 p 467–470

(FTD-TT-64-696/1+2; AD-456409)

An attempt is made to explain the phenomena occurring in a photoelectret, assuming that the free electrons are secured in close vicinity to the atoms from which they have been dissociated, so that they form peculiar dipoles–photodipoles, and that the polarization is homogeneous all along the specimen. The laws of the photopolarization and photodepolarization of photoelectrets are obtained under certain assumptions. Author

N65-23946# Hoffman Electronics Corp., Santa Barbara, Calif. Science Center Div.

INFRARED IMAGE CONVERTER Quarterly Report, 1 Aug.–31 Oct. 1964

C. C. Nash 31 Oct. 1964 9 p

(Contract NOw-64-0185-c)

(QR-3; AD-456522)

The iodide transport was modified with arsenic doped germanium source material and growth substrate wafers of p-type gallium arsenide and p-type germanium. The deposited layers obtained were single crystal and joined solidly to the substrate. Test diodes made from these epitaxial junctions exhibited soft reverse breakdown. Successive deposition runs with the same arsenic doped source material and germanium and gallium arsenide substrate wafers established the source of contamination as the gallium arsenide substrate wafers. A furnace and reaction tube system was assembled for epitaxial growth by continuous flow of gallium chloride and arsenic vapors in a hydrogen atmosphere. Dome epitaxial heterojunctions between p-type gallium arsenide and n-type germanium were formed, and measurements of the junction reverse recovery time were made. Attempts to measure hole storage time with a type S diode recovery unit were negative. Satisfactory hole injection from a P_1 layer of gallium doped germanium was obtained. G.G.

N65-24066# California Univ., Berkeley. Lawrence Radiation Lab.

CRYSTAL STRUCTURES AND CRITICAL TEMPERATURES OF SOME NEW SUPERCONDUCTING COMPOUNDS

Zelma Jean Johnston 5 May 1964 37 p refs

(Contract W-7405-ENG-48)

(UCRL-11390)

An investigation of transition metal alloys having crystal structures favorable for superconductivity has resulted in the discovery of two new superconductors: Mo_3Al_2C, β-Mn structure, at 10.0° K and Mo_2BC, orthorhombic structure, at 5.4° K. Also, the previously reported transition temperature of Nb_2Al, σ-phase, and the extrapolated transition temperature of MoC, cubic B1 structure, were found to be too low; our observed values were 13.5° K and 14.2° K, respectively. The role of crystal structure, generally assumed to be a secondary one in determining the superconductive properties of a material, seems open to question. The transformation of MoC from hexagonal to cubic was found to be accompanied by a 7° K change in transition temperature. Such large changes cannot be accounted for by the normal electron-to-atom ratio, but must be controlled by the lesser known parameters, such as band structure and the electron density of states at the Fermi surface. Since these parameters are definitely related to the crystal structure, the importance of the atomic arrangement must not be ignored. Author

N65-24108*# National Aeronautics and Space Administration, Washington, D. C.

ON THE EFFECT OF ELECTRON DENSITY INHOMOGENEITIES ON MEASUREMENT OF SOME PARAMETERS OF THE IONOSPHERE [O VLIYANII NEODNORODNOSTEY ELEKTRONNOY KONTSENTRATSII IONOSFERY NA IZMERENIYE NEKOTORYKH YEYE PARAMETROV]

Ya. A. Ryzhov and O. I. Yudin Jul. 1962 16 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 5, no. 1, 1962 p 13–20

(NASA-TT-F-8267) CFSTI: HC $1.00/MF $0.50

The method is based on measurement of phase invariant of a three-harmonic wave and it has been proposed for electron density measurement using artificial satellites. The effect of radio diffraction of waves in ionospheric inhomogeneities on the fluctuation of the gas invariant is examined. Discussed is the question of fluctuations of the reduced Doppler frequency difference on account of diffraction in random electron concentration inhomogeneities. Estimate is given of the precision of measurement by that method. Author

N65-24119# National Cash Register Co., Dayton, Ohio. Research Div.

INVESTIGATION OF ELECTRON TRANSPORT THROUGH ULTRA-THIN INSULATOR AND CONDUCTOR FILMS Interim Engineering Report, 1 Jan. 1963–31 Aug. 1964

Wright-Patterson AFB, Ohio, AF Avionics Lab. [1964] 61 p refs

(Contract AF 33(657)-10459)

(IER-2; AD-461735)

The report describes instrumentation and measurements in evaluation of the NCR chemical spray process as a technique for producing insulator films for metal–insulator–metal sandwiches, and measurements of photoconduction and trapping in reactively sputtered tantalum oxide films. Although the results on the spray process are inconclusive they indicate that this method is probably not suitable for the fabrication of pinhole-free films thinner than about 0.1 micron. The method of thermally stimulated currents (TSC) is shown feasible for the detection of traps in insulator films. The TSC results for several films prepared under different conditions are analyzed and correlated with their photoconductive behavior. Author

N65-24124*# Field Emission Corp., McMinnville, Oreg.

BEHAVIOR OF VARIOUS ADSORBATES ON METAL SUBSTRATES Quarterly Progress Report No. 3, 1 Dec. 1964–28 Feb. 1965

C. J. Bennette, R. W. Strayer, and L. W. Swanson 20 Apr. 1965 49 p refs

(Contract NAS3-5902)

(NASA-CR-54132) CFSTI: HC $2.00/MF $0.50

The work function variation with coverage for cesium or rhenium and molybdenum was measured; the shape of the resulting curves is similar to that for tungsten, with a slight shift in minimum toward low coverages in the case of rhenium. In addition, an investigation of adsorption and desorption of thin mercury films on molybdenum substrates established that (1) mercury adsorbed on molybdenum raises work function; (2) for coverages above a monolayer mercury is mobile at 77° K; (3) applied fields of 25 Mv/cm or greater cause growth of mercury protrusions from the mobile layer at 77° K for certain coverages; and (4) all mercury is completely desorbed from molybdenum at 650° K. Field ion microscope investigations of

xenon ion sputtering of tungsten resolved sputtering detail as fine as individual atom displacements, and determined amount of surface and interior damage as functions of ion energy and surface crystallographic direction. Author

N65-24149 Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
AN EXPERIMENT ON HELICON WAVES IN InSb
F. Lindvall *In its* Interaction between Microwaves and Plasmas in Gas Discharges and Semicond. 31 Mar. 1965 p 129–148 refs (See N65-24142 13-25)

The propagation of circularly polarized electromagnetic waves in a circular semiconductor cylinder surrounded by a metal tube and immersed in a dc magnetic field is studied in a theory where the finite transverse dimension is taken into account. A simple dispersion relation is derived from which the propagation constants are determined. An experiment was performed in which the rf transmission at 9000 Mc through a disk of InSb at 80° K was measured. The results are in fairly good agreement with the theory. Author

N65-24190# Syracuse Univ., N. Y. Coll. of Engineering
HETEROJUNCTION DEVICES Final Report, 1 May 1963–30 Nov. 1963
R. L. Anderson, G. Zeidenbergs, S. Yawata et al Griffiss AFB, N. Y., RADC, Mar. 1965 127 p refs
(Contract AF 30(602)-3059)
(RADC-TR-64-560; AD-614676)

The opto-electric characteristics of abrupt Ge-GaAs heterojunctions were investigated to determine if such devices are efficient photon detectors. Because of a notch in the band edge at the interface, the quantum efficiency is low. Further, such a device as the collector in an optical transistor is concluded to be impractical. A method of determining the minority carrier lifetime in the Ge adjacent to the GaAs, from the photocurrent spectrum, is developed. Near the band gap of Ge, the photocurrent spectrum exhibits changes in slope attributable to the onset of phonon assisted absorption. An efficient photodetector is described which utilizes a Ge-Si n-n heterojunction. A qualitative theory for this is developed. Photo-excited holes are trapped in the notch in the valence band which in turn modulates the diode current. An apparatus for probing semiconductor devices is described. The thermoelectric and photovoltaic methods are used. Author

N65-24191# Varian Associates, Palo Alto, Calif. Central Research Lab.
A STUDY OF SOLID STATE MICROWAVE DEVICES AND PHENOMENA (RESEARCH ON THE GUNN EFFECT) Interim Engineering Report
H. Kroemer and G. F. Day Wright-Patterson AFB, Ohio, Res. and Technol. Div., Apr. 1965 43 p refs
(Contract AF 33(657)-11015)
(IER-6; AD-462724)

Theoretically, the earlier computer simulations of Gunn oscillations were extended to lower doping values. On a conceptual level, it was shown that a finite relaxation time is not necessary to obtain the observed dipole domains. Relaxation rate limitations should be negligible compared to diffusion effects for relaxation times short compared to 4×10^{-12} sec. It has been found that applied fields in excess of ~ 2000 volts/cm cause carrier generation in high resistivity n-types GaAs. The current increase with time in Gunn diodes made from this material, which are biased above the threshold voltage, can cause microwave oscillations even though the low-field carrier concentration is insufficient to permit oscillation. This current-controlled onset of oscillation has been studied in some detail. The oscillations begin at a carrier concentration-length product of $\sim 7 \times 10^{10} cm^{-2}$, in agreement with theoretical considerations and the computer simulated runs. The carrier lifetime is 3×10^{-8} seconds. Author

N65-24199# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SELF-DIFFUSION OF LEAD AND TELLURIUM IN LEAD TELLURIDE
Mario Pio Gomez (Ph.D. Thesis–Stanford Univ) Jun. 1964 144 p refs
(LMSC-A034298; AD-614566)

Defect structure of PbTe was investigated by studying self-diffusion of Pb and Te as a function of deviation from stoichiometry and temperature. Microlapping and radioactive tracer techniques were used to determine the diffusion coefficients from concentration vs. penetration profiles corresponding to the Van Ostrand–Dewey solution of Fick's second law. Self-diffusion of Pb-210 can be explained by assuming that two mechanisms operate, one at high Te concentrations with activation energy of 61 kcal per mole, and one at low Te concentrations and excess Pb with activation energy of 24 kcal per mole. Diffusion coefficient D_{Pb} exhibited a minimum at all temperatures and at compositions close to stoichiometry, on the Te side. The Te self-diffusion coefficient decreases with decreasing Te concentration and has an activation energy of 24 kcal per mole. From dependence of the diffusivities upon concentration and temperature was concluded that Frenkel defects are present in the Pb sublattice and that interstitial Te is the predominant anion defect. Presence of Te vacancies cannot be established. Author

N65-24209# Martin Co., Baltimore, Md. RIAS Div.
EMBRITTLEMENT OF ZINC MONOCRYSTALS AND BICRYSTALS BY MERCURY AND GALLIUM Technical Report No. 65-3
M. H. Kamdar and A. R. C. Westwood Mar. 1965 38 p refs
(Grant DA-31-124-(AROD)-63)
(AROD-3937-4; AD-613701)

Results of a test of fracture behavior of zinc monocrystals and asymmetric bicrystals in tension at room temperature, coated with liquid mercury or gallium, are consistent with the view that adsorption of the active liquid metal specifically at some stable obstacle to slip is a prerequisite for embrittlement. The data from the bicrystal studies provide experimental support for the theoretical criteria for fracture in zinc proposed by Likhtman–Shchukin and Gilman. From these data, a value of 48 ± 3 ergs/cm^2 was deduced for the fracture surface energy of zinc in the presence of mercury, in good agreement with earlier determination of this quantity. The results of the investigation are discussed with regard to earlier work by Shchukin and others. Author

N65-24365# General Telephone and Electronics Labs., Inc., Bayside, N. Y.
STUDY OF THIN FILM COMPOUNDS FORMED FROM SIMULTANEOUSLY EVAPORATED CONSTITUENTS Final Report, 1 Jun. 1963–31 Jan. 1965
M. S. Wasserman, A. K. Hagenlocher, and A. E. Feuersanger [1965] 63 p refs
(Contract DA-36-039-AMC-00105(E))
(TR-65-206.6; AD-613568)

Thin films of lead titanate suitable for forming thin-film capacitors were prepared by the simultaneous evaporation

of lead and titanium oxides in an oxygen atmosphere. Experimental conditions for deposition of the films on silicon substrates were established for obtaining virtually a 100% yield of films with a specific capacitance greater than $1\mu F/cm^2$, dielectric constants from 200 to 400, and a dissipation factor less than 10%. This high reproducibility derives from improved understanding and control of the vapor-phase oxidation of titanium and of the interactions between the dielectric film and the metal electrodes. The current procedure for synthesis of the lead titanate films is given. Related previous work is summarized, and a literature survey given. Author

N65-24367# Brown Univ., Providence, R. I. Barus Physics Lab.
STUDY OF SURFACE PROPERTIES OF ATOMICALLY-CLEAN METALS AND SEMICONDUCTORS. PART 1: STUDY OF CdS SURFACES BY LEED. PART 2: COMBINED LEED AND MASS SPECTROMETER MEASUREMENTS FOR ADSORPTION AND CATALYSIS Progress Report, 1 Jun.–31 Dec. 1964
H. E. Farnsworth and B. D. Campbell [1964] 26 p refs
(Contract DA-28-043-AMC-00299(E))
(PR-6; AD-613699)

Oxygen adsorption on the $(000\bar{1})$ MATTE surface of CdS was enhanced by at least a factor of 10^4 when an intense light was incident on the crystal. High temperature heating in vacuum (850° C) produced $\{1\bar{1}03\}$ thermal etch planes on the $(000\bar{1})$ MATTE surface. It was found that the presence of oxygen before or during the light exposure increased the effect of the light, possibly indicating photoabsorption of oxygen. It was also found that ion bombardment increased the dark conductivity and decreased the effect of an intense light, indicating that the observed changes in conductivity took place in a region close to or at the surface. Unlike the (0001) MATTE surface, the (0001) SPECULAR surface was not affected by exposure to an intense light. Oxygen exposures of 750 torr/min in the dark and 3300 torr/min in intense light produced little change in both the diffraction pattern and the subsequent dark conductivity of the (0001) SPECULAR surface. Author

N65-24386*# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
SECONDARY ELECTRON EMISSION
R. E. Bunney 31 Dec. 1964 97 p refs
(Grant NsG-570)
(NASA-CR-54366) CFSTI: HC $3.00/MF $0.75

Available literature on secondary electron emission from metallic surfaces is reviewed. The basic theories of secondary electron emission are considered in relation to one another. Special emphasis is placed on the quantum theories. Author

N65-24388*# California Univ., Berkeley. Space Sciences Lab.
INVESTIGATION OF KILOVOLT ION SPUTTERING Quarterly Progress Report
Harold P. Smith, Jr. and F. C. Hurlbut 30 Apr. 1965 31 p refs
(Contract NAS3-5743)
(NASA-CR-54406) CFSTI: HC $2.00/MF $0.50

A radioactive tracer technique has been developed and successfully applied to the measurement of the yield and angular distribution of copper sputtered from a monocrystalline target under bombardment by a 1- to 10-keV cesium ion beam with the beam parallel to the <100> crystallographic vector. The yield is seen to reach a maximum at 7 keV and is considerably lower than that reported for polycrystalline targets. The relative openness of the (100) face is the probable reason for the significant reduction. A possible application of this effect to ion rocket electrode design is noted. The angular distribution as a function of energy is presented. Preferred ejection in the <100> and <110> directions as well as in the {111} planes is noted. A comparison of the angular distribution with energy of the incident ion is presented and discussed. Further progress in the development of a mercury ion sputtering apparatus and in the time-of-flight velocity spectrum technique is presented. Finally, a suitable collector for activation analysis of sputtered aluminum has been tested and found satisfactory. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N65-23667*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRELIMINARY INVESTIGATION OF BLAST HAZARDS OF RP-1/LOX AND LH_2/LOX PROPELLANT COMBINATIONS
John B. Gayle, Charles H. Blakewood, James W. Bransford, William H. Swindell, and Richard W. High 9 Apr. 1965 35 p refs
(NASA-TM-X-53240) CFSTI: HC $2.00/MF $0.50

This report discusses the current status of information regarding the blast hazards of liquid propellants, and presents results obtained from one part of a comprehensive analytical and experimental investigation of this problem. The data generally were consistent with siting criteria now used for RP-1/LOX. However, explosive yields determined for LH_2/LOX were markedly lower, and this suggests that current siting criteria for this propellant combination may be overly conservative. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N65-23594# United Aircraft Corp., Sunnyvale, Calif. Research and Advanced Technology Dept.
IGNITION OF SOLID-PROPELLANT MOTORS UNDER VACUUM Final Report, 4 Dec. 1963–4 Dec. 1964
R. B. Beyer 8 Apr. 1965 186 p refs
(Contract AF 04(611)-9701)
(UTC-2079-FR; AFRPL-TR-65-74; AD-461379)

Low-pressure ignition characteristics of four igniter systems were studied with thin-webbed motors. Results showed that the principal parameter influencing the motor ignition time for a rocket exhaust, a pyrotechnic, and a hypergolic igniter system is the mass flow rate per unitport area of the igniter

products. The data support the thesis that propellant response, or ignitibility behavior, can be separated from igniter action regardless of igniter type. An important observation of hypergolic ignition is that a pressurizing oxidizer system is necessary for subatmospheric ignition, accomplished by a mixed oxidizer consisting of an active hypergol and an inert component that can flash vaporize when sprayed into the motor. Only scattered results were obtained with the conductive-film igniter system, and no satisfactory experimental relationships could be determined. Author

N65-23666*# Marquardt Corp., Van Nuys, Calif.
PROGRAM FOR SEA LEVEL TEST FIRING OF ROCKET ENGINES Final Report, 1 Sep. 1964–1 Feb. 1965
R. J. Reiner Feb. 1965 99 p
(Contract NAS9-3465; TMC Proj. 641)
(NASA-CR-65008; S-454) CFSTI: HC $3.00/MF $0.75

The results of firing two 5-lb thrust bipropellant rocket engines with radiation cooled thrust chambers of molybdenum, coated with #RM-055 were reported. This coating was developed to withstand high temperature environments with high resistance to both oxidation and erosion. One chamber achieved a burn time of 130 seconds at a maximum recorded temperature of 2780° F, and the second accumulated 210-seconds operation at a maximum recorded temperature of 3000° F. Both chambers burned through near the nozzle throat where very little coating was present to provide oxidation protection. Prior to these tests, two cylindrical molybdenum tubes coated with RM-055 achieved a life of 60 to 70 minutes without failure at a temperature of 3100° F in a vacuum bell jar. From these tests it was concluded that the coating has potential capability to protect at the high temperature. Further development processing is required for the achievement of a process to deposit the coating uniformly on the substrate material. E.E.B.

N65-23695*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENVIRONMENTAL EFFECTS ON LABORATORY AND IN-FLIGHT PERFORMANCE OF NEUTRALIZATION SYSTEMS
J. M. Sellen, Jr. (Space Tech. Labs., Inc., Redondo Beach, Calif.) and Ronald J. Cybulski Washington, NASA, 1965 35 p refs Presented at the 2d AIAA Aerospace Sci. Meeting, New York, 25–27 Jan. 1965
(Contract NAS3-4114)
(NASA-TM-X-52093; AIAA Paper-65-70) CFSTI: HC $2.00/MF $0.50

Environmental effects as they have influenced experiments on ion thrust beams in three particular environmental configurations are reviewed. These configurations were the small chamber (4-meter) neutralization experiments with the electron-bombardment mercury ion thrustor; the large chamber (25-meter) experiments with the contact ionization cesium ion thrustor; and the flight test of the electron-bombardment engine on the SERT I spacecraft. Also, some of the diagnostic techniques are reviewed and further diagnostic techniques, particularly those applicable for space flight tests of ion thrustors, are discussed. The effective neutralization of the ion thrust beams was demonstrated in both controlled laboratory experiments and in the SERT I space test. In the laboratory tests the exhaust beam potential was 5 to 10 volts positive with respect to the neutralizer. In the SERT I test the measured thrust agreed with the calculated thrust within 5%. This demonstrated that the ions attain the acceleration energy they would achieve under perfect neutralization to within, at most, second-order effects. E.E.B.

N65-23717*# Rocket Power, Inc., Pasadena, Calif.
RESEARCH ON CHARGED COLLOID PROPULSION Summary Report
S. P. Harris 1 Feb. 1965 24 p refs
(Contract NAS3-2597)
(NASA-CR-54192) CFSTI: HC $1.00/MF $0.50

A beam of charged colloidal carbon particles was produced and measured using a cold cathode-type ion source and a colloidal carbon feeding device. The beam was collected on a collecting electrode. Photomicrographs of some of the carbon particles collected were taken. Average charge to mass ratios for the charged colloidal carbon were computed. They showed considerable variation but were of the order of magnitude of 1000 C/kgm. A very lightweight ballistic pendulum was used for beam thrust observation. Author

N65-23900*# Space Technology Labs., Inc., Redondo Beach, Calif.
SURVEYOR VERNIER THRUST CHAMBER ASSEMBLY DEVELOPMENT, PHASE III, VOLUMES 1, 2, AND APPENDIXES
R. C. Rupert, H. Shieber, and A. F. Grant 26 Feb. 1965 1156 p refs In three volumes Prepared for JPL
(Contracts NAS7-1000; JPL-950596)
(NASA-CR-62771; STL-8422-6013-TU-000) CFSTI: HC $7.62/MF $3.50

The thrust chamber assembly (TCA) program is reported. Operation and performance characteristics of the variable thrust, bipropellant rocket engine, and detailed description of the assembly and its component parts are documented. The test history is presented, including tests under all specified interface conditions and with expected extremes of environmental conditions. The integrated TCA having successfully completed its prequalification test program is shown ready for use in overall systems tests, and for entry into a formal qualification test program. Author

N65-23959# Bolkow Entwicklungen K. G., Munich. (West Germany).
HIGH PRESSURE ROCKET POWER UNITS FOR SPACE TRANSPORTERS
M. Kaufmann [1964] 14 p Presented at Eurospace Conf., Brussels, 23–24 Jan. 1964

The importance of specific impulse, propellant, and expansion ratio in the development of high pressure rocket power units is discussed. Also, the feasibility of higher combustion chamber pressure is considered. Data are given for the ratio of launching weight to payload weight of a single stage orbital rocket at an altitude of 200 km as a function of the specific impulse in vacuum for various ratios of the weight of the structure to the launching weight; the specific impulse of fluid propellants at an expansion rate of 70 atm and 1-atm balancing flow; the theoretical specific impulses of H_2/O_2 as a function of combustion chamber pressure and of the relation of the jetpipe diameter to the jetpipe outlet pressure; the jetpipe area ratio at ground level as a function of the combustion chamber pressure for $O_2 : H_2 = 5.5 : 1$; and the combustion chamber and jetpipe neck diameters as functions of combustion chamber pressure and of ground thrust for H_2/O_2. E.E.B.

N65-24005# Thiokol Chemical Corp., Huntsville, Ala.
ARMY MATERIALS RESEARCH AGENCY NOZZLE AND CASE EVALUATION Quarterly Interim Technical Report, 22 Sep.–21 Dec. 1964

S. P. Gualillo, D. L. Daigle, T. H. Burns, E. J. Mc Cool, and R. E. Bradley 31 Mar. 1965 30 p ref
(Contract DA-01-021-ORD-11919)
(Rept.-15-65; AD-460796)

A 12 1/2-inch diameter, cryogenically formed, rocket motor case was hydrotested to failure at −65° F to establish the influence of a case defect on performance. The case was revealed by radiographic inspection to contain a circumferential defect 0.005 inch wide by 0.150 inch long in the heat affected zone near the aft dome to cylindrical weld. Depth of the defect was about 75% of the 0.55-inch wall thickness. The burst pressure of the case was 2635 psig with a calculated hoop stress at burst of 297 000 psi. The fracture pattern was normal, originating in the straight cylindrical section and propagating into the dome section in the longitudinal direction. Photographs showing the case before and after hydroburst are shown. The metallurgical evaluation of the case is also presented. Further, the static evaluation of a 2.0-inch diameter titanium boronitride nozzle insert resulted in satisfactory performance. E.E.B.

N65-24007# Catholic Univ. of America, Washington, D. C. Stress Analysis Labs.
AN EXPERIMENTAL STUDY OF STRESSES AT THE INTERFACE OF PROPELLANT GRAINS AND MOTOR CASES DUE TO THERMAL LOADING OF THE SHRINKAGE TYPE
A. J. Durelli and V. J. Parks Feb. 1965 6 p ref
(Contract AF 04(611)-10378)
(PR-1; AD-614656)

A number of urethane rubber models were cast and shrunk on steel strips with various cross sections. The purpose of the variations was to find a way to subject the rubber model to restraint in the plane of the model without restraining the out-of-plane shrinkage at the bonded edge. A comparison of the photoelastic patterns obtained from two of the models is used to demonstrate the marked difference between a pinched and an unpinched boundary. E.E.B.

N65-24024# Bristol Siddeley Engines, Ltd. (England). Advanced Propulsion Research Group
COMPARATIVE METHODS OF SPACE BOOSTING
R. J. Lane, C. J. Austin, and M. J. Welch [1964] 25 p Presented at Eurospace Conf., Brussels, 23–24 Jan. 1964

This paper compares, on a percentage payload basis, some possible space-boosting combinations recently suggested. The conclusion is that the winged recoverable air-breathing booster with top-stage chemical rockets is a possibility for the boosting of a space transporter vehicle. Author

N65-24027# Societe d'Etude de la Propulsion par Reaction, Villejuif (France).
CONSIDERATIONS ON ROCKET PROPULSION FOR AN AEROSPACE VEHICLE
J. Tubeuf and J. Bedel [1964] 29 p Presented at the EUROSPACE Conf., Brussels, 23–24 Jan. 1964

Several low density cryogenic or storable biliquid propergols which are capable of furnishing specific thrust from 390 to 420 seconds, and which are available for use in rocket engines of aerospace vehicles, are described. Data on the weight and dimensions of motors with different thrusts, specific theoretical and practical consumption figures for different propergols under varied operating conditions, the weight and dimensions of reservoirs for carrying the propergols, the admissible evaporation rates for several cryogenic propergols, the possibility of modifying thrust, the problem of restarting in space, and cryogenic combinations of propergols, are included. The chemical characteristics, storage, and production of rocket fuels and oxidizers, are also included. S.C.W.

N65-24054# Giravions Dorand Co., Paris (France).
UTILIZATION OF AERIAL ROTARY PROPELLERS, RECOVERABLE, FOR THE STARTING OF A SPACE ENGINE [UTILISATION DE PROPULSEURS AERIENS ROTATIFS, RECUPERABLES, POUR LE LANCEMENT D'UN ENGIN SPATIAL]
Jan. 1964 23 p In FRENCH

An aircraft propeller, when properly stabilized and controlled (blades or fans streamlined) has the well known advantage of being able to assure the approach and landing of an engine at null speed at a given point. It remains to be seen if the drop in efficiency of these propellers at supersonic speeds in rarefied atmospheres, in addition to their weight, poses a risk of affecting their performance. The object of this work is to examine briefly, in a comparative manner and using bases for calculation, in which conditions the use of an aerial propeller for the first stage of launching a space engine would become advantageous from a performance point of view.
Trans. by M.P.G.

N65-24056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF HIGHLY REACTIVE CHEMICAL ADDITIVES TO IMPROVE AFTERBURNER PERFORMANCE AT ALTITUDE
John P. Wanhainen and Joseph N. Sivo Washington, NACA, 30 Sep. 1958 25 p refs
(NACA-RM-E58G10) CFSTI: HC $1.00/MF $0.50
(Declassified)

An investigation was conducted in an altitude test chamber to evaluate the use of highly reactive chemicals injected into a turbojet afterburner to promote the combustion process, which was inhibited by water vapor from compressor-inlet injection. The chemicals evaluated were commercial hydrogen and aluminum trimethyl. The aluminum trimethyl was used as an additive to the afterburner hydrocarbon fuel, and the hydrogen was injected separately into the piloting zones of the afterburner. Engine-inlet water–air ratio and hydrogen fuel flows were systematically varied to determine the effects of the degree of contamination by water vapor and the amount of chemical additive on afterburner operating limits and combustion efficiency. The afterburner-inlet conditions simulated flight at a 98 000-foot altitude and Mach 3.0. Addition of small amounts of hydrogen increased the combustion efficiency over the entire operating range of the afterburner with more pronounced effects at the low equivalence ratios. Afterburner operating limits were greatly extended by the injection of hydrogen. Stable operation of the afterburner was obtained to an equivalence ratio of 0.26 with a hydrogen flow of 3 percent and no water vapor present in the afterburner-inlet air. A 14-percent concentration of aluminum trimethyl in the afterburner hydrocarbon fuel resulted in only marginal improvement in afterburner performance. Author

N65-24058*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME DESIGN PRINCIPLES FOR TURBOJET COMBUSTORS OPERATING ON BORON-CONTAINING FUELS
Warner B. Kaufman Washington, NASA, Jun. 1959 55 p refs
(NASA-MEMO-6-3-59E) CFSTI: HC $3.00/MF $0.50
(Declassified)

The problems associated with the use of boron-containing fuels in the primary combustor of a turbojet engine are: (1) those presented by fuel decomposition within fuel injectors or on external surfaces thereof and by impingement of fuel on hot surfaces; and (2) those presented by the accumulation of a product of combustion, viscous liquid boric oxide, on combustor surfaces. The first can be alleviated by insulating or cooling the fuel passages, by preventing recirculation

around the fuel port, and by injecting the fuel in a finely atomized spray. The second can be minimized by blanketing the inside surfaces of the combustor liner with uncontaminated combustion air. Small-diameter air-atomizing fuel injectors, each bathed in a strong jet of air, ran consistently free of fuel decomposition products. The performance of a highly louvered, annular combustor was unaffected by the small quantity of boric oxide deposited on its surfaces. The fuels used included pentaborane, a 66% blend of pentaborane in JP-4, HEF-2 (propylpentaborane), and HiCal-3 (ethyldecaborane). Combustion efficiencies were 89% to 93%. Author

N65-24102# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THE OSCILLATING-ELECTRON ION ENGINE FOR SPACE APPLICATION
Edward A. Pinsley, Allan P. Walch, Thomas L. Churchill, and Conrad M. Banas Wright-Patterson AFB, Ohio, ASD, May 1962 206 p refs
(Contract AF 33(616)-8376)
(A-910002-1; ASD-TDR-62-410; AD-329457) (Declassified)

An experimental program of applied research was conducted during the period from June 1, 1961 through March 31, 1962 to investigate the oscillating-electron ion engine for space application. Several engine configurations were designed and tested using various expellants in a high-vacuum test facility. Thrust was determined by direct measurement using an engine-mounted balance technique. The experiments show conclusively that the oscillating-electron mechanism for the acceleration of ions produces thrust under conditions of current and space-charge beam neutrality. Results of supporting experimental research on the effects of electrode geometry, magnetic field, and type of cathode are also reported. Author

N65-24103# Space Technology Labs., Inc., Redondo Beach, Calif.
DESIGN OF A MODULAR SOURCE CONTACT ION ENGINE Final Report, 1 Jun. 1962–30 Apr. 1963
S. G. Forbes, J. C. Beynon, D. A. Gordon, and M. E. Kirkpatrick Aug. 1963 171 p refs
(Contract AF 33(657)-8687)
(STL-8671-6010-RC-000; ASD-TDR-63-545) (Declassified)

In developing a high performance ion engine of modular design to provide extension to higher thrust levels, the principal design concept was the use of a parallel array of slit accelerators to produce an engine having high perveance per unit area so that high current densities, and therefore high electrical efficiency, could be obtained in the specific impulse range of interest in mission application. Thrust levels up to 10 mlb were obtained from a single module having an emitter area of 16 cm^2. Power-to-thrust levels as low as 200 kW/lb and ion beam current densities up to 37.8 mA/cm^2 were obtained. The report covers optimization considerations, engineering design and development, engine performance data, and future potential. Author

N65-24104# United Aircraft Corp., East Hartford, Conn. Research Labs.
APPLIED RESEARCH ON THE OSCILLATING-ELECTRON ION ENGINE Final Report, May 1, 1962–Feb. 28, 1963
Edward A. Pinsley, Allan P. Walch, Conrad M. Banas, Jack W. Davis, and Thomas L. Churchill Wright-Patterson AFB, Ohio, ASD, Apr. 1963 284 p refs
(Contract AF 33(616)-8376)
(B910065-9; ASD-TDR-63-253) (Declassified)

An experimental program of applied research on the oscillating-electron ion engine was conducted during the period from May 1, 1962 to February 28, 1963. A large number of engine configurations were designed, fabricated, and tested to determine the effect of electrode and magnetic field geometry on engine performance. Thrust measurements were obtained by means of an engine-mounted thrust balance. Single-element engine thrust levels up to 7 mlb and multielement engine thrust levels of over 13 mlb were achieved in the specific impulse regime of 2000 to 3000 seconds. Author

N65-24286# Royal Aircraft Establishment, Farnborough (England).
THE SOLAR-THERMAL PROPULSION UNIT: THEORETICAL PERFORMANCES AND THE ONERA PRODUCTION PROJECT [LE PROPULSEUR HELIOTHERMIQUE PERFORMANCES THEORIQUES ET PROJECT DE REALISATION ONERA]
J. Surugue and E. Le Grives London, Min. of Aviation, Feb. 1965 61 p refs Presented at the 14th Congr. Intern. d'Astronautique, Paris, 25 Sep.–1 Oct. 1963

Theoretical design work on a gas jet propulsion system is described, wherein the working fluid is heated in a system of tubes surrounding an energy-collecting cavity which is situated at the focus of a collector mirror directed at the sun. The design of the collector mirror, cavity–heater, and fluid system are considered in detail. Author

N65-24375*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
AN ELECTROLYTIC TANK ANALOG FOR TWO-DIMENSIONAL ANALYSIS OF ELECTROSTATIC-THRUSTOR OPTICS
John F. Staggs Washington, NASA, May 1965 35 p refs (NASA-TN-D-2803) CFSTI: HC $2.00/MF $0.50

An electrolytic tank analog used for two-dimensional analyses of electrostatic-thrustor ion optics is described in detail. This analog has unique features that increase the ease of operation and versatility beyond previously reported designs. A generalized procedure, which permits a wide variety of space-flow problems to be solved quickly and accurately, is used for space-charge simulation. Solutions are given for operational problems encountered in the practical use of the analog, and some analyses of specific thrustor accelerator configurations are presented to illustrate procedures and important applications of the analog. The use of the analog as a precursor to a more accurate digital computer analysis is recommended to speed up the initial investigation of a thrustor configuration. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N65-23386 Liege Univ. (Belgium). Institut d'Astrophysique
QUANTITATIVE ESTIMATES OF THE AMOUNTS OF ULTRAVIOLET RADIATION TO BE EXPECTED FROM STARS

L. Houziaux *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 61–83 refs (See N65-23383 13-30)

The region extending from the Lyman limit to a wavelength around 3200 Å is considered, excluding the Lyman line of hydrogen, for estimates of energy received from stars as given by model stellar atmospheres in radiative equilibrium. Values from tables representing the characteristics for the continuous spectrum of unreddened stars are employed to predict the absorption of energy by interstellar matter for the case of a $O_{9.5}V$ star located at 0.5, 1, and 2 kpc which will be absorbed by various magnitudes at 5500 Å. It was found that interstellar matter would absorb 99% of the energy at 1250 Å for a star located at 2 kpc, and the color excess 5000 to 1800 Å would amount to 2.6 magnitudes. Values from the same table were used to derive the amount of energy emitted at a certain wavelength by a whole galaxy, and it was found that such a galaxy could radiate the same energy as a ninth magnitude B_6 star if no red shift effects are considered. G.G.

N65-23393 Centre National de la Recherche Scientifique, Paris (France). Institut d'Astrophysique

GAMMA RAYS

E. Schatzman *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 147–154 refs (See N65-23383 13-30)

The observation of photons with an energy greater than 50 KeV centers on the distinction between solar gamma rays and galactic or extragalactic X-rays. Slow scanning of the sky can be used to study the radio sources and the general flux. Energies of 1 MeV are required to scan the sun and flare star emissions, and energies of 1 to 200 MeV are required to observe supernovae and radio sources. The need to use a veto system to discriminate between gamma and cosmic rays and the need to eliminate phenomena arising in connection with the crossing of the Van Allen belts constitute difficulties in these observations. G.G.

N65-23394 Commissariat a l'Energie Atomique, Saclay (France).

METHODS FOR THE SATELLITE-BORNE STUDY OF GAMMA RADIATION

J. Labeyrie *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 155–170 refs (See N65-23383 13-30)

Since permanent solar and galactic gamma fluxes are very weak their measurement by satellite requires protection of the detectors against the influence of the relatively strong earth flux. Gamma-ray detectors should have the following characteristics: (1) good sensitivity, implying a large area and high efficiency; (2) directivity to the nearest degree; (3) energy definition with an accuracy of a few percent, in order to identify the lines; and (4) power to select the photons against isotropic background of parasitic photons with a 100 times greater intensity, and a background of charged particles and neutrons. Up to 3 MeV the weight and volume of the detectors are 10 kg and 3 dm^3 respectively, and simple electronic circuits are used. Sensitivity of these detectors is about 10^{-2} gamma cm^{-2} sec^{-1}. Higher energy detectors weigh a few tens of kilograms and reach sensitivity of 10^{-3} cm^{-2} sec^{-1} in space, with similar electronic circuits to those used up to 3 MeV. The spark chamber requires image transmission. G.G.

N65-23449# Rice Univ., Houston, Tex. Dept. of Space Sciences

NUCLEAR GAMMA RAYS FROM SUPERNOVA REMNANTS

R. C. Haymes, W. L. Craddock, and D. D. Clayton [1965] 18 p refs Presented at COSPAR Conf., Buenos Aires, May 1965

It is calculated that, if the Cf^{254} hypothesis of Burbidge et al is correct, the Crab Nebula presently has a radioactive energy input of 1.2×10^{38} erg/sec, of which 92% is in the form of kinetic energy of alpha particles and fission fragments. That much energy would be significantly related to observed properties of the Crab. To clarify the (1) source of supernova light curves, (2) location and mechanism of heavy-element nucleosynthesis by rapid neutron captures, and (3) present-day energy balance in supernova remnants, the possibility was evaluated of experimentally testing the Cf hypothesis by searching for 2.7×10^{34} erg/sec radiated by the Crab in gamma-ray lines associated with transbismuth radioactivity. The anticipated line spectrum is complex. The strongest line flux from the Crab is 9.7×10^{-5} cm^{-2} sec^{-1} for the 390 keV line of Cf^{249}. Stronger line fluxes may come from the X-ray source in Scorpius if it is also a Type I remnant. The requirements for a gamma-ray telescope capable of resolving the lines from the continuous background are discussed. The chance of detection appears favorable from a satellite and possible from balloons. Author

N65-23711*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy

AN INTERPLANETARY DIFFUSION MODEL FOR THE TIME BEHAVIOR OF INTENSITY IN A SOLAR COSMIC RAY EVENT

S. M. Krimigis 1 Apr. 1965 62 p refs *Its* Rept.-65-7
(Grant NsG-233-62; Contract Nonr-1509(06))
(NASA-CR-62647) CFSTI: HC $3.00/MF $0.75

It is found possible to give a coherent interpretation of the time history of the intensity of several solar cosmic-ray events in terms of a unified interplanetary diffusion model which assumes that the diffusion coefficient $D = M\, r^{\beta}$, where r is the heliocentric radial distance and M and β are parameters, which may be dependent on particle energy E. The model is successful in accounting for the decay phases. For the September 28, 1961 event, M varies as $E^{0.33}$ and, assuming spherical geometry, β is equal to one for $55 < E < 500$ MeV and decreases rapidly at lower energies. At $r = 1$ AU the mean free path λ is about 0.081 AU for $E \sim 200$ MeV and 0.15 for $E = 23$ MeV. The energy dependences of β and λ suggest 0.006 AU as the order of magnitude of the scale size of irregularities in the interplanetary magnetic field. The source spectrum is inferred. The possibility of nonspherical geometry of diffusion is considered, as is the implication of the results with respect to the solar modulation of galactic cosmic radiation. Author

N65-23833*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy

ADIABATIC MOTION OF AURORAL PARTICLES IN A MODEL OF THE ELECTRIC AND MAGNETIC FIELDS SURROUNDING THE EARTH

Harold E. Taylor and Edward W. Hones, Jr. Apr. 1965 78 p refs
(Grant NsG-233)
(NASA-CR-62730; SUI-65-10) CFSTI: HC $3.00/MF $0.75

Motion of charged particles in the electric and magnetic fields constituting the earth's magnetosphere is calculated assuming that the first and second adiabatic invariants are conserved. The model of the magnetic field includes the effects of the solar wind pressure on the sunward side of the magnetosphere and of the newly discovered current sheet in the magnetospheric tail. The electric field is deduced in the ionosphere from the SD current system which accompanies

magnetic bays. The magnetic field lines are assumed equipotentials so the electric field can be projected throughout the magnetosphere. Motion of low energy plasma is discussed qualitatively, that of solar wind particles which become trapped on the surface of the magnetosphere, quantitatively. Solar wind electrons are found to be accelerated to energies from 1 to 40 keV and confined to a narrow latitudinal zone where extensive precipitation into the atmosphere occurs during local nighttime. Protons of similar energy will be confined to a region south of the electron region and will precipitate during local afternoon and evening. Author

N65-23859# Boeing Co., Seattle, Wash. Aero-Space Div.
SUMMARY OF SOLAR RADIATION OBSERVATIONS
R. A. Atlas and B. N. Charles Dec. 1964 15 p In cooperation with Weather Bur., Washington
(D2-90577-1)

A statistical summary of solar radiation data received by 27 stations of the U.S. Weather Bureau over a nominal period of 11 years is described. The basic data are described, statistical relations and procedures used are defined, and the tabular summaries delivered to the Weather Bureau are listed. Summaries include frequency distribution of atmospheric transmissivity stratified by months and seasons for various weather conditions of cloud cover, sunshine, visibility, and precipitation. Linear correlation coefficients between transmissivity and visibility, cloud cover, and solar elevation angle are also included. Author

N65-23901*# National Aeronautics and Space Administration, Washington, D. C.
RADIO EMISSION OF VENUS AT 4 MILLIMETERS [RADIOIZLUCHENIYE VENERY NA VOLNE 4 MM]
A. G. Kislyakov, A. D. Kuz'min, and A. E. Salomonovich Aug. 1962 14 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 39, no. 3, 1962 p 410–417
(NASA-TT-F-8270) CFSTI: HC $1.00/MF $0.50

Observations of Venus' radio emission in the 4-mm wavelength were made with the aid of a 22-meter radiotelescope. The brightness temperature referred to the visible part of the disk of the planet, and was found to be minimum in the lower conjunction and equal to 390° ±120° K. The brightness temperature increases somewhat with the increase of distance from the lower conjunction. Since the antenna parameters were not determined with sufficient accuracy, it was possible only to estimate this increase, which by the end of the observations did not exceed 230° K. At that time, the relative area of the illuminated part of the disk was 0.34. The value of brightness temperature obtained at 4 mm was very close to that observed in the 8-mm wavelength, and this suggests a comparatively low radiation absorption in the planet's atmosphere. Obviously, further comparisons with the results obtained in the centimeter band will allow conclusions concerning the general physical conditions on Venus. Author

N65-23902*# National Aeronautics and Space Administration, Washington, D. C.
EMISSION OF FLARES IN THE X-RAY REGION OF THE SPECTRUM [IZLUCHENIYE VSPYSHEK V RENTGENOVOSKOY OBLASTI SPEKTRA]
A. S. Dvoryashin, L. S. Levitskiy, and A. K. Pankratov Aug. 1962 20 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 39, no. 3, 1962 p 428–438
(NASA-TT-F-8273) CFSTI: HC $1.00/MF $0.50

World data on the ionosphere (f_{min}) bursts of radio emission in the centimeter band and on chromospheric flares are used. The study of the connection between time characteristics (time of commencement, maximum, and termination) of X-radiation and radio emission of flares, and characteristics obtained from observations in the optical region of the spectrum showed that the time dependences of X-radiation and radio emission practically coincide. However, the flare emission in H_α commences prior to the time of intensity increase of these phenomena. From the comparison of the minimum reflection frequencies f_{min}, registered during ordinary and proton flares, a considerable increase in the intensity of X-radiation from proton flares is found. A large hardening of the X-radiation spectrum of the intense proton flares of March 23, 1958 and July 14, 1959 was detected. Assuming that additional ionization in the ionosphere originates at heights of 60 kilometers (for radiation's tangential incidence to the D-layer) it is concluded that superhard protons with energies up to ~1 MeV should be generated during the development of intense proton flares. Author

N65-23903*# National Aeronautics and Space Administration, Washington, D. C.
ON THE SPATIAL STRUCTURE OF THE SOLAR CORONA [O PROSTRANSTVENNOM STROYENII SOLNECHNOY KORONY]
E. R. Mustel' Sep. 1962 25 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 39, no. 3, 1962 p 418–427
(NASA-TT-F-8275) CFSTI: HC $1.00/MF $0.50

Problems connected with the corpuscular streams are emphasized. Relationships between quiescent prominences—filaments and coronal streamers—are discussed. The law governing the solar corona's structure is considered, as is the intermediate-type corona, characterized by a decreased brightness in the low latitude belt, and an increased brightness in the midlatitude belts. The former includes those of active regions, and the latter, the streamers' belt. In the first of two hypotheses considered for the explanation of the low latitude belt, these properties are determined by such large-scale solar characteristics as the general magnetic field of the sun, its rotation, etc. In the second those properties are determined by the fact that active regions deflect the corpuscules originating through the continuous ejection of solar gases from the sun, thus creating above them empty cavities. It is shown that the latter hypothesis meets with serious difficulties. Main geometrical properties of the streamers are discussed with special attention given to the streamers' extension. Author

N65-23905*# National Aeronautics and Space Administration, Washington, D. C.
SOME RESULTS OF THE EXPERIMENTS CARRIED OUT IN THE INTERPLANETARY SPACE BY MEANS OF CHARGED PARTICLE TRAPS ON SOVIET COSMIC ROCKETS [NEKOTORYYE REZUL'TATY OPYOOV PROVEDENNYKH V MEZHPLANETNOM PROSTRANSTVE S POMOSHCH'YU LOVUSHEK ZRRYAZHENNYKH NA SOVETSKIKH KOMICHESKIKH RAKETAKH]
K. I. Gringauz Sep. 1962 22 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), v. 12, 1962 p 119–132
(NASA-TT-F-8279) CFSTI: HC $1.00/MF $0.50

Experiments conducted with three-electrode traps on Soviet cosmic rockets are reviewed. Information on the ionized gas in the space surrounding the rockets during their flight and on low-energy particle fluxes lying below the sensitivity of cosmic-ray indicators are considered. Further, the study of the currents induced by charged particles at various portions of the rocket's trajectory, and a comparison of currents registered

simultaneously in the traps with different potentials are covered. The apparatus is described in detail and the data on the outermost belt of charged particles surrounding the earth are given. E.E.B.

N65-23906*# National Aeronautics and Space Administration, Washington, D. C.

EARTH'S RADIATION BELTS IN THE 180–250 KM ALTITUDE RANGE [RADIATSIONNYYE POYASA ZEMLI NA VYSOTAKH 180–250 KM]

S. N. Vernov, I. A. Savenko, P. I. Shavrin, V. E. Nesterov, and N. F. Pisarenko Sep. 1962 14 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), v. 13, 1962 p 67–74 (NASA-TT-F-8280) CFSTI: HC $1.00/MF $0.50

Radiation data obtained by scintillation counter with a NaJ(Tl) crystal by the spaceship satellite number three traveling in an 187-km perigee and 265-km apogee orbit were compared with those from spaceship number two which traveled at altitudes from 306 to 339 km, to trace the intensity variation and geographic position of the radiation belts at passing to lower altitudes. The radiation intensity of the outer belt in the Southern Hemisphere at 330-km mean altitude was about 2.2 times higher than that in the Northern Hemisphere at a mean altitude of 320 km. The ratio was 4.4 times for the same measurements at altitudes of 235 km in the Southern Hemisphere and 185 km in the Northern Hemisphere. It was concluded that the radiation intensity decreases two times in the outer belt at passing from 235-km to 185-km altitude. The South Atlantic region of increased intensity shifted toward the northwest by comparison with the position determined aboard the second spaceship. Radiation registered over the Brazilian magnetic anomaly showed a decrease of proton intensity radiation of almost one order at altitudes from 320 km to 220 km. G.G.

N65-23907*# National Aeronautics and Space Administration, Washington, D. C.

MEASUREMENT OF THE ABSORBED DOSE ON THE THIRD SPACESHIP-SATELLITE [IZMERENIYE POGLOSHCHENNOY DOZY NA TRET'YEM KOSMICHESKOM KORABLE-SPUTNIKE]

I. A. Savenko, N. F. Pisarenko, P. I. Shavrin, and S. F. Papkov Sep. 1962 7 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), v. 13, 1962 p 81–84 (NASA-TT-F-8281) CFSTI: HC $1.00/MF $0.50

A Soviet spaceship satellite, equipped with instrumentation to detect and to establish the distribution of radiation at the lower boundary of the radiation belts, was hurled into an orbit with a 187-km perigee and a 65-km apogee. Results of the measurement were compared with those of a previous flight. The radiation belt profiles obtained from the dosimetric measurements of the satellife revealed that the bremsstrahlung intensity from the electrons of the inner radiation belts decreased by about 2.5 times in the Northern Hemisphere and by 30 percent in the Southern Hemisphere. The measurements also revealed a decrease in the bremsstrahlung intensity in the region of the Brazilian magnetic anomaly and a decrease in the proton component in that region. In conclusion, the flight was instrumental in establishing the fact of the inner belt lowering in the region of the Brazilian anomaly and in revealing the presence of comparatively intense fluxes of weakly penetrating corpuscular radiation in the near-equatorial regions. C.L.W.

N65-23915*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

ROCKET MEASUREMENTS OF COSMIC NOISE INTENSITIES BELOW 5 Mc/s

J. K. Alexander and R. G. Stone Apr. 1965 26 p refs (NASA-TM-X-55216; X-615-65-185) CFSTI: HC $2.00/MF $0.50

The experimental payload which consisted of a short dipole antenna, four TRF receivers, a reference noise source, and an antenna impedance probe reached an apogee altitude of 1070 km during the 20-minute flight. The measured cosmic background noise intensities, for a hemisphere centered near the North Galactic Pole are not inconsistent with the interpretation of the turnover in the noise spectrum below 5 Mc/sec as being due to absorption by nearby galactic HII regions having an emission measure the order of 5 cm^{-6} pc. Anomalous radio noise enhancements at low altitudes are shown to be associated with resonance effects in the antenna impedance in the ionospheric plasma. Author

N65-23933*# Space Technology Labs., Inc., Redondo Beach, Calif.

DIRECT DETECTION OF AMBIENT ELECTRON PLASMA OSCILLATION FIELDS IN THE MAGNETOSPHERE, APPENDIX D

F. L. Scarf and R. W. Fredricks Mar. 1965 6 p refs (Contract NASw-698) (NASA-CR-62753; STL-8494-6007-SU-000 Append. D) CFSTI: HC $1.00/MF $0.50

Recently radio noise measurements were reported on 700 kc/sec and 2.2 Mc/sec at altitudes between 3000 and 11 000 km from a high-altitude rocket probe. A relatively high background brightness at 700 kc/sec and several intense noise bursts were also observed. It was suggested previously that nonthermal source mechanisms such as harmonic gyro radiation and EM radiation from plasma waves could contribute to the high 700-kc/sec background, and radiation from relativistic electrons was considered as the source of one of the noise bursts which appeared on both channels near the geomagnetic equator. However it was observed that the most intense noise burst appeared only on the lower channel and at an altitude for which the local electron plasma frequency approached 700 kc/sec. A possible interpretation of this event is discussed. It is suggested that the probe antennas were simply responding to the electrostatic fields associated with the thermal or equilibrium level of electron plasma oscillations, rather than to any local resonance. E.E.B.

N65-24036*# National Aeronautics and Space Administration, Washington, D. C.

MEASUREMENT OF THE FAR ULTRAVIOLET HELIUM EMISSION ON THE SUN [IZMERENIYE DALEKOGO UL'TRAFIOLETOVOGO IZLUCHENIYA GELIYA NA SOLNTSE]

A. V. Bruns and V. K. Prokof'yev 27 May 1962 13 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), v. 11, 1961 p 15–22 (NASA-TT-F-8232) CFSTI: HC $1.00/MF $0.50

Results of far ultraviolet measurements of ionized-helium resonance-lines (HeII λ303.8) by a diffraction spectrometer aboard the third Soviet spaceship on Dec. 1 and 2, 1960 are reported. The measurements were averaged into thirteen 177-second cycles during which the spectrometer was oriented toward the sun. All cycles were considered equivalent, the pulses were summed up for every second of every cycle, and the calibrations for the spectrometer were introduced to reduce the random fluctuations. The results indicate that the magnitude of the λ303.8 line intensity at 200-km to 210-km heights at about a 50° zenith angle of the sun is about 0.5 $erg \cdot cm^{-2} \cdot sec^{-1}$. M.P.G.

N65-24037*# National Aeronautics and Space Administration, Washington, D. C.
COSMIC RAY EQUATOR ACCORDING TO THE DATA OF THE THIRD SOVIET SPACESHIP-SATELLITE [EKVATOR KOSMICHESKIKH LUCHEY PO DANNYM TRET'YEGO SOVETSKOGO KORABLYA-SPUTNIKA]
I. A. Savenko, V. E. Nesterov, P. I. Shavrin, and N. F. Pisarenko 20 May 1962 7 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), v. 11, 1961 p 30–34
(NASA-TT-F-8227) CFSTI: HC $1.00/MF $0.50

The geographic position of the line of minimum intensity of primary cosmic radiation (the cosmic ray equator) was determined by the third Soviet spaceship-satellite. A halogenous gas-discharge counter, a scintillation counter equipped with a NaI crystal, and a photomultiplier were among the instruments used. From the data collected, reduced, plotted, and compared, it is concluded that the cosmic ray equator determined in the third spaceship-satellite, according to energy liberation in the scintillation counter's crystal, coincided with a precision to 1° by latitude, and to 0.4° by longitude with the equator measured by the Geiger counter. A.S.

N65-24115*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SOLAR CONSTANT AND SPECTRAL DISTRIBUTION OF SOLAR RADIANT FLUX
Matthew P. Thekaekara [1961] 46 p refs Submitted for Publication
(NASA-TM-X-51677) CFSTI: HC $2.00/MF $0.50

A survey was made of the data currently available on the solar constant and the spectral distribution of the solar radiant flux. The relevant theoretical considerations on radiation, solar physics, scales of radiometry, and thermal balance of spacecraft were briefly discussed. The survey shows that results from different sources have wide discrepancies, that no new experimental data have been taken in recent years, and that the conventional technique of extrapolation to zero air mass leaves large uncertainties. The feasibility of further measurements and of a new method of approach was discussed. Author

N65-24136* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN EVALUATION OF A TECHNIQUE FOR PREDICTING SOME INDICATORS OF SOLAR ACTIVITY
Jeanette A. Scissum and Robert E. Smith *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 93–95 (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

Results of prediction models must be monitored to insure that specific failure or low success areas are detected and corrected at the earliest possible time in the developmental stage of the system. In this report, results of a method for predicting solar flare occurrence probabilities, amount of 2800-Mc solar noise flux, and geomagnetic activity are compared with actual observations of these parameters on the surface of the earth. It is concluded that the technique is successful; however, there is a tendency toward a persistency-type of prediction, not unusual in the formulative stage of most prediction techniques. Author

N65-24219# Milan Univ. (Italy). Istituto di Scienze Fisiche
LATITUDE EFFECT ON NEUTRON ALBEDO FLUX Scientific Report No. 4.
G. Boella, G. Degli Antoni, C. Dilworth, G. Pizzi, L. Scarsi et al (1st Nazl. di Fis. Nucl., Milan) 1 Mar. 1965 12 p refs
(Contract AF 61(052)-808)
(AFCRL-65-225; AD-614918)

The latitude effect on the neutron albedo flux, near solar minimum, is investigated. It is shown that the variation of counting rate of a neutron detector as a function of residual atmospheric pressure and of latitude is dependent on the efficiency-versus-energy response of the detector employed. On the basis of the results obtained and of other published data, a qualitative estimate is given of the variation of the albedo neutron energy spectrum and total flux, with geomagnetic cutoff rigidity. Author

N65-24233# Joint Publications Research Service, Washington, D. C.
WILL WE OVERCOME THE RADIATION BARRIER?
Yu. Volynkin 24 May 1965 9 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), 26 Mar. 1965 p 3
(JPRS-30202; TT-65-31054) CFSTI: $1.00

The effects of the flux intensity and distribution of various sources of radiation in outer space on human biological systems, and the possible hazards of ionizing radiation during prolonged manned space flights are discussed. Emphasized are the effects of cosmic radiation, solar radiation, and the ionizing radiation of the radiation belt around the earth. It is concluded: (1) In a prolonged manned flight in free cosmic space, the integral dose due to primary cosmic radiation will increase; however, on lunar missions it will not exceed the maximum established dose for cosmonauts. (2) The possibility of a spaceship entering dangerous solar flare radiation will depend upon the average probability of the flare and the duration of the extraterrestrial journey. Danger increases during periods of increased solar activity and increased flight time. (3) Radiation of the outer radiation belt will be small provided the space ship is behind a shield of 1 g/cm^2. This shield blocks the electrons of the inner radiation belt and reduces the dose. S.C.W.

N65-24273# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.
SOLAR COSMIC RAYS IN A REGULAR INTERPLANETARY MAGNETIC FIELD Scientific Report No. 19
Sidney M. Bennett 27 Jan. 1965 74 p refs
(Contract NSF C-255)
(RAD-TR-64-43)

The theory of high-energy protons in a regular interplanetary magnetic field is extended to admit the strong heliocentric dependence of the interplanetary magnetic field strength, resulting in an event decay phase whose character is somewhat steeper than inverse time squared. Detailed comparison is made with the Explorer XII data for the 28 September 1961 event. Good to excellent fits are obtained for all energies for which data were obtained (2.2–430 MeV). The temporal and spatial variations of an impulse source of high-energy protons in the magnetic field of a filamentary current are investigated. Late in the event, the center of the magnetic tube becomes depleted and only the boundary region retains a significant number of protons and may be the mechanism producing the SC-max-type polar cap absorption (PCA). Pre-SC-max PCA events result when the earth is near the center of a magnetic tube at the time of solar cosmic ray injection. Should the magnetic tube corotate with the solar active region, the 27-day recurrence tendency in energetic protons observed by Explorer XII and by 2.3 Mc ionospheric backscatter would result from long-term storage of protons in the regular interplanetary magnetic field. It is concluded that the magnetic plasma streams arising in solar centers of activity may determine the temporal and spatial features of high-energy proton events. Author

N65-24274# International Geophysical Year World Data Center A, Boulder, Colo.
INTERMEDIATE REPORT OF PROMINENCE (FILAMENT) ACTIVITY, 1964
1 May 1965 83 p *Its* Solar Activity Rept. Ser. No. 31

Assembled in chronological order are the daily prominence reports of the cooperating observatories. Author

N65-24303*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy
INWARD RADIAL DIFFUSION OF ELECTRONS E > 1.6 MeV IN THE OUTER RADIATION ZONE
L A. Frank Apr. 1965 27 p refs *Its* Rept.-65-13
(Grant NsG-233-62; Contract Nonr-1509(06))
(NASA-CR-62860) CFSTI: HC $2.00/MF $0.50

Observations of the temporal variations of electron (E > 1.6 MeV) intensities near the geomagnetic equator in the outer radiation zone with Explorer XIV suggest that replenishment of energetic electrons in the outer radiation zone during the several weeks following a period of geomagnetic activity proceeds by an inward radial motion of energetic electrons from L > 5. The apparent, inward radial velocity of the wave of electrons (E > 1.6 MeV) is ~0.4 earth radius $(day)^{-1}$ at L = 4.7 and ~0.03 earth radius $(day)^{-1}$ at L = 3.4 and varies as $\sim L^8$ between these L-shells. These inward radial velocities for the several replenishment cycles of outer zone electrons (E > 1.6 MeV) observed at a given L-shell are equal to within experimental errors. These measurements provide evidence for a continually active mechanism for diffusing energetic electrons across L-shells in the outer radiation zone. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N65-23383# Eurospace, Paris (France).
REPORT OF THE WORKING GROUP ON THE LARGE ASTRONOMICAL SATELLITE, REVIEW OF THE SCIENTIFIC OBJECTIVES
Mar. 1964 225 p refs
(SR-1)

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N65-23384 Eurospace, Paris (France).
REVIEW OF THE WORK AND GENERAL RECOMMENDATIONS
H. E. Butler *In its* Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 2–13 refs (See N65-23383 13-30)

The primary instrumentation of a stabilized satellite observatory, capable of making astronomical observations, is an ultraviolet spectrographic instrument designed to observe objects beyond the solar system. It should possess a wavelength range of 912 to 3500 Å and the spectral resolution should be variable by ground control within 1 to 100 Å. The instrument direction should respond to ground control. An X-ray telescope should be mounted parallel to the ultraviolet instrument as a primary second device to record broadband observations. Integrating image tubes should be developed parallel to scanning photomultipliers. G.G.

N65-23385 Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
FUNDAMENTAL REQUIREMENTS OF MODERN ASTRONOMY
L. Biermann *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 14–60 refs (See N65-23383 13-30)

The use of telescopes in an orbiting satellite as devices for forming images of extended objects, and also as light gathering instruments for feeding photometers, through filters and polarizing plates, or spectrometers is discussed. The superiority of the orbiting telescope over ground based instruments

is due to a much larger usable wavelength range, the lower background brightness of the sky, and the absence of atmospheric blurring of the images. Telescopes will be required to observe: (1) down to 1000 Å wavelength the physics of single stars with emphasis on stars earlier than FO; (2) close double stars and doubles of unequal brightness and mass; (3) star clusters and associations, and observational problems of stellar evolution and population types; (4) interstellar gas and dust, and gaseous and planetary nebulae; (5) extragalactic nebulae; (6) gamma radiation of extragalactic or galactic origin; and (7) planets and comets. Tables present lists of stars according to population types, position in the H-R diagram, or other physical characteristics. G.G.

N65-23387 Liege Univ. (Belgium). Institut d'Astrophysique
STELLAR PHOTOMETRY
M. Golay and L. Houziaux (Geneva Obs.) *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 84–100 refs (See N65-23383 13-30)

A fairly large telescope of 80-cm diameter is proposed for high-accuracy photometry with carefully selected filters in astrophysical satellite observations of the ultraviolet. Individual measurements of the greatest number of stars in star clusters and stellar associations should be made. Several color indices were computed from assumed rough filters with pass band widths of 950 to 3050 Å under consideration of fluxes derived from model atmospheres to describe the photometric properties of stars in the ultraviolet. The received tables represent only the continuous spectra of unreddened stars, and show that the high-temperature stars are less easily separated than the lower temperature ones. G.G.

N65-23390 Utrecht Observatory (Netherlands).
X-RAY ASTRONOMY
C. de Jager *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 127–134 refs (See N65-23383 13-30)

The following three wavelength regions are suggested for investigations of possible X-ray fluxes from nonsolar sources: (1) 12 to 20 Å—detection of stellar corona and exploration of the nearby parts of the galaxy up to several kpc; (2) 5 to 10 Å—exploration of the whole galaxy and detection of energetic sources; and (3) 1 to 3 Å—detection of distant extragalactic, very energetic sources. A paraboloid frustrum mirror is recommended for investigations of the first region, and the application of counters with a wide Be window is suggested for investigations of the shortest wavelength region. Simple collimating baffles may obtain angular resolutions of 10′ to 1°. G.G.

N65-23392 Stockholm Observatory (Sweden).
IMAGING THE SUN IN X-RAYS
Y. Ohman *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 143–146 refs (See N65-23383 13-30)

A brief summary of American rocket and satellite observations of solar X-radiation is presented. Preliminary results show rapid changes taking place in X-ray flux and confirm the importance of obtaining high time-resolution X-ray images of the sun, especially when the sun is active. A number of proposed solar experiments are outlined to be used on rockets and satellites. A possible X-ray imaging of the sun by an instrument with more radiation gathering capacity than the pinhole camera is discussed. This experiment assumes the development of a mirror system for X-rays including an image tube, but before such an instrument is ready no detailed plan can be worked out. G.G.

N65-23395 Kapteyn Astronomical Lab., Groningen (Netherlands).
STUDIES OF INTERSTELLAR MATERIAL
J. Borgman *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 171–181 refs (See N65-23383 13-30)

Investigations of interstellar matter center on studies of the nature of the interstellar material with emphasis on wavelength dependence of extinction, polarization, and reflection, and on studies of the galactic structure with emphasis on the negative role of extinction in the spatial distribution of stars. Reliable models of the extinction curve are needed to extrapolate the observed color excesses to absolute extinction values. Observation of the ultraviolet beyond the ozone cutoff is recommended. Photometric and polarimetric investigations of 1000 early-type stars in the ultraviolet bands of 100 Å width, work on diffuse and planetary nebulae, reflection nebulae, and stellar classification parameters should be included in the astronomical observations by satellite. Such a project would call for 50 hours of measuring time at photometric mean errors of less than 1%, not including time for pointing the telescope, data reading, etc. G.G.

N65-23396 Stockholm Observatory (Sweden).
MEASUREMENTS OF POLARIZATION
Y. Ohman *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 182–189 refs (See N65-23383 13-30)

Polarization measurements made from above the earth's atmosphere make it possible to (1) extend the wavelength of observation into the ultraviolet and X-ray regions as well as into those infrared and radio wavelengths which are not transmitted by the earth's atmosphere; (2) measure faint light sources which might be hindered by atmospheric illumination; and (3) observe the polarization of selected fine structure elements of the sun and the planets which cannot be readily studied at ground level. A brief review on polarization measuring devices and methods is given, and the polarization effects to be expected in the ultraviolet, X-ray, and infrared regions are discussed. Some of the difficulties involved by including polarimetric work in an astronomical satellite are pointed out. It was concluded that observation of interstellar polarization would probably be the most attractive polarimetric study. G.G.

N65-23398 Oxford Univ. (England).
THE RESTRICTIVE EFFECTS OF SCATTERED SUNLIGHT ON THE OBSERVATION OF STARS FROM A SATELLITE
D. E. Blackwell *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 196–202 refs (See N65-23383 13-30)

Evaluated are the following three effects of scattering of sunlight which may hinder the observation of stars from a satellite: (1) scattering by gas from jets used for the stabilization of the satellite; (2) scattering by the earth's atmosphere at heights above 300 km; and (3) scattering by the instrument. It was concluded that the effects from the first two causes are negligible, but that the effects of sunlight scattering by the instrument may be serious and might necessitate the erection of an occulting disk in front of the instrument. G.G.

N65-23399 Stockholm Observatory (Sweden).
THE ZODICAL LIGHT AND GEGENSCHEIN
Y. Ohman *In* Eurospace Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 203–204 refs (See N65-23383 13-30)

Observations of the zodical light and Gegenschein by a broadband detector from a sunlit satellite are discussed, and the restrictive effects of scattered sunlight are pointed out. It was concluded that both experiments should be given a low priority in astronomical satellite observations. G.G.

N65-23401 Eurospace, Paris (France).
ORBITS AND PAYLOADS FOR AN ASTRONOMICAL SATELLITE
J. Vandenkerckhove *In its* Rept. of the Working Group on the Large Astron. Satellite Mar. 1964 p 219–222 (See N65-23383 13-30)

Some general information pertaining to launching of an astronomical satellite in a near earth orbit is presented. Selection of the orbit depends on the weight of the satellite, sufficient height to keep the lifetime of the satellite reasonably long, and selection of the orbital inclination. The possible weight of the astronomical satellite of more than 500 kg will limit orbits to near polar, and an inclination of about 98° will have to be selected. The dimensions of the payload compartment are determined by the heat shield design and the diameter of the last stage. G.G.

N65-23403 Joint Publications Research Service, Washington, D. C.
SOME PECULIARITIES OF THE ORBITAL TRANSFER OF A SPACECRAFT, INDUCED BY A SINGLE PULSE
A. A. Shilov *In its* Eng. Journal 26 Apr. 1965 p 1–10 refs (See N65-23402 13-23) CFSTI: $6.00

The peculiarities of single-impulse orbital transfer of a spacecraft with a large kinetic energy into the orbit of a planetary satellite were studied. Using a system of conservation of energy and movement moment equations to express the radii of the perigee and apogee, the position of the spacecraft in the initial orbit is determined at the moment of application of the impulse. By solving the described systems of equations, the solution of any system transformation can be found R.C.S.

N65-23404 Joint Publications Research Service, Washington, D. C.
APPLICATION OF A MAGNETOQUER TO SATELLITE ORIENTATION IN SPACE
K. B. Alekseyev and G. G. Bebenin *In its* Eng. Journal 26 Apr. 1965 p 11–27 refs (See N65-23402 13-23) CFSTI: $6.00

Two- and three-axis satellite dynamics are studied, control rules are selected, and design principles of a control system based on the magnetorquer are outlined. Using a system of differential equations of angular satellite motions, static and nonstatic open and closed control systems are examined. Results indicate that only two angular coordinates of the satellite can be controlled using moment magnetorquer; open control systems with three or two channels appear to be structurally unstable; and the control system requires three to four times less current in the stabilization regime than in the control regime. R.C.S.

N65-23437 Library of Congress, Washington, D. C. Aerospace Technology Div.
MANY-IMPULSE OPTIMAL PLANE TRANSFERS IN A HOMOGENEOUS CENTRAL GRAVITATIONAL FIELD
L. Kacinskas *In its* Foreign Sci. Bull., Vol. 1, No. 5 May 1965 p 30–33 refs (See N65-23432 13-34)

The theory of the motion of a variable mass point in a central gravitational field of a spacecraft is developed with the aid of Pontryagin's maximum principle under the assumption that the motion takes place in a sufficiently narrow cylindrical or spherical layer. On the basis of the derived expressions, optimal control of the thrust is qualitatively analyzed, and various possible types of operating regimes for such control are derived. To obtain quantitative solutions of the problem, many-impulse optimal plane transfers are considered. A general theory of many-impulse transfers is presented under the assumptions that the motion of the point takes place in a narrow layer and that its velocity is close to the circular velocity. On the basis of the theory developed, a detailed analysis is made of optimum energy transfers from the initial orbit to the point and of the optimum energy transfers between two coplanar elliptic orbits. All solutions of extremal equations are obtained, and the parameters of the most economical optimal transfers are indicated. Author

N65-23438 Library of Congress, Washington, D. C. Aerospace Technology Div.
VOSKHOD-2: MAN IN SPACE AND BIOTECHNOLOGY
Boris N. Mandrovsky *In its* Foreign Sci. Bull., Vol. 1, No. 5 May 1965 p 34–41 refs (See N65-23432 13-34)

Data on the flight of Voskhod-2, collected from recent Soviet and Soviet-bloc newspaper and popular magazine sources, shed light on the internal arrangement of the ship, food and water rations, spacesuit design, cabin and suit atmospheres, and the "walk" in space performed by Leonov. Author

N65-23578 Academy of Sciences (USSR), Moscow. Astronomical Council
AN ATTEMPT TO PHOTOGRAPH A FLASH LIGHT ON THE BACKGROUND OF THE STARS [OPYT FOTOGRAFIROVANIYA VSPYSHEK IMPUL'SNOY LAMPY NA FONE ZVEZDNOGO NEBA]
A. M. Lozinsky, V. I. Belenko, G. V. Romanova, A. S. Beloborodova, and A. M. Shilkin *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964 p 3–6 In RUSSIAN; ENGLISH summary (See N65-23577 13-07)

Photographing with the camera NAFA 3c/25 of a flash light onboard an aircraft with the background of the stars is described. Author

N65-23579 Academy of Sciences (USSR), Moscow. Astronomical Council
DETERMINATION OF THE DISTORTION AND THE FOCAL LENGTH FOR THE OBJECTIVE-LENS OF THE CAMERA NAFA-3c/25 AND A CAMERA WITH A MOVING FILM [OPREDELENIE DISTORSII I FOKUSNOGO RASSTOYANIYA OB'EKTIVOV NAFA-3c/25 I KAMERY S PODVIZHNOY PLENKOY]
A. G. Kirichenko and A. A. Sychev *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964 p 6–8 refs In RUSSIAN; ENGLISH summary (See N65-23577 13-07)

The distortion was determined according to A. A. Kiselev's method. The distortion coefficient amounts to $(0.98 \pm 0.09) \cdot 10^{-5}$ mm^{-2}. That the distortion coefficient is not symmetrical as respect to the optical center is shown. Author

N65-23587 Academy of Sciences (USSR), Moscow. Astronomical Council
PRELIMINARY MEAN ORBITAL ELEMENTS OF THE CABIN OF THE FIRST SOVIET SPACE SHIP (1960 ϵ_3) FOR JANUARY–JUNE 1963 [PREDVARITEL'NYE SREDNIYE ELEMENTY ORBITY KABINY PERVOGO SOVETSKOGO KOSMICHESKOGO KORABLYA (1960 ϵ_3) NA YANVAR'-IYUN' 1963 GODA]
G. A. Chebotarev and E. N. Makarova *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 38 Jun. 1964 p 27–29 In RUSSIAN (See N65-23577 13-07)

Equatorial orbital elements and periodic disturbances of the orbit of the first Soviet spaceship are tabulated. The elements were obtained by smoothing the data from visual observations. The orbit of the cabin was close to circular. Orbital elements derived from photographic observations of various satellites are tabulated by observing stations. M.P.G.

N65-23640 Academy of Sciences (USSR), Moscow. Astronomical Council
AVERAGE ORBITAL ELEMENTS OF THE CABIN OF THE FIRST SOVIET SPACE SHIP (1960 E_3) FOR AUGUST–DECEMBER 1963 [SREDNIYE ELEMENTY ORBITY KABINY PERVOGO SOVETSKOGO KOSMICHESKOGO KORABLYA (1960 E_3) ZA AVGUST–DEKABR' 1963 G]
G. A. Chebotarev and E. N. Makarova *In its* Opt. Observation Sta. of Artificial Earth Satellites, Bull. No. 40 1964 p 34–36 In RUSSIAN (See N65-23625 13-07)

Average equatorial orbital elements of the satellite 1960 E_3 have been obtained according to the program devised in the Institute of Theoretical Astronomy. Each system of elements was determined by smoothing visual observation data and machine computation. The orbital elements obtained are compared with those obtained in England. M.P.G.

N65-23653# Tartu Astronoomia Observatooriumi (USSR).
REPORTS OF THE TARTU ASTRONOMICAL OBSERVATORY, NO. 10 [SOOBSHCHENIYA TARTUSKOY ASTRONOMICHESKOY OBSERVATORII, NO. 10]
1964 29 p refs In RUSSIAN; ENGLISH summaries

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1. A PRELIMINARY SYSTEM OF GALACTIC PARAMETERS Ya. Eynasto and S. A. Kutuzov p 1–10 refs (See N65-23654 13-30)

2. SOME REMARKS ON METHODS OF DETERMINING THE ROTATION OF THE NEUTRAL HYDROGEN SUBSYSTEM S. A. Kutuzov p 11–28 refs (See N65-23655 13-30)

N65-23654 Tartu Astronoomia Observatooriumi (USSR).
A PRELIMINARY SYSTEM OF GALACTIC PARAMETERS [PREDVARITEL'NAYA SISTEMA OKOLOSOLNECHNYKH GALAKTICHESKIKH PARAMETROV]
Ya. Eynasto and S. A. Kutuzov *In its* Rept. of the Tartu Astron. Obs., No. 10 1964 p 1–10 refs In RUSSIAN; ENGLISH summary Presented at the Session of the Working Group on Dyn. of Galaxies, Astron. Council, Leningrad, May 1964 (See N65-23653 13-30)

Equations for the general parameters of the galactic parameters are formed and used for the overall adjustment of all these parameters. The observational values of the galactic parameters derived by critical analysis of the published data are presented in table form. The theoretical equation of Stroemberg's asymmetry has been used for various galactic subsystems to obtain the observational estimate of the circular velocity. G.G.

N65-23655 Tartu Astronoomia Observatooriumi (USSR).
SOME REMARKS ON METHODS OF DETERMINING THE ROTATION OF THE NEUTRAL HYDROGEN SUBSYSTEM [ZAMECHANIYA K METODAM OPREDELENIYA VRASHCHENIYA PODSISTEMY NEYTRAL'NOGO VODORODA]
S. A. Kutuzov *In its* Rept. of the Tartu Astron. Obs., No. 10 1964 p 11–28 refs In RUSSIAN; ENGLISH summary Presented at the Session of the Working Group on Dyn. of Galaxies, Astron. Council, Leningrad, May 1964 (See N65-23653 13-30)

Three methods are presented to determine the expansion effect of a neutral hydrogen subsystem in rotation. All methods require a preliminary rough model of both rotation and expansion for introducing the expansion effect. The first method is based on consideration of the extremal values for the centroid radial velocity, the second method assumes that the hydrogen distribution possesses axial symmetry, and the third method makes use of the profiles without integrating them. G.G.

N65-23672*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN NONLINEAR LAWS OF MANEUVERING A GLIDING WINGED SPACECRAFT WHILE WITHDRAWING IT FROM A CIRCULAR ORBIT TO A LANDING STRIP [O NEKOTORYKH NELINEYNYKH ZAKONAKH UPRAVLENIYA KOSMICHESKIM PLANIRUYUSHCHIM KRYLATYM APPARATOM PRI VYVEDENII S KRUGOVOY ORBITY NA VZLETNO-POSADOCHNUYU POLOSU]
V. S. Vedrov, G. P. Vladichin, A. A. Kondratov, G. L. Romanov, and V. M. Shalaginov Apr. 1965 25 p refs Transl. into ENGLISH of USSR Paper 7–3, 26 Jan. 1965 26 p
(NASA-TT-F-9328) CFSTI: HC $1.00/MF $0.50

Guiding a winged spacecraft from a circular orbit to a ground landing strip through a corridor in the H, V coordinates is discussed; nonlinear laws of center-of-mass control are given to solve this problem. Equations are derived for control of lateral and longitudinal motion. Optimum curves are plotted for descent along the corridor, and an automatic control system for withdrawal of the craft to a landing site is given, with a block diagram. The derived control law, with continuous correction of the reversal point, ensures an exact trajectory of motion and gliding at maximum banking angle. Author

N65-23673*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF SPACE VEHICLE MOTION IN THE ATMOSPHERE [ISSLEDOVANIYE DVIZHENIYA KOSMICHESKIKH APPARATOV V ATMOSFERE]
D. Ye. Okhotsimskiy and N. I. Zolotukhina May 1965 26 p refs Transl. into ENGLISH of USSR Paper 7-2, 1965 25 p
(NASA-TT-F-9329) CFSTI: HC $2.00/MF $0.50

The motion of a spacecraft in the atmosphere, after reentry through the reentry corridor with special emphasis on the g-loading, is described. Descent trajectories with local parabolic velocity at an altitude of 100 km, using the height of perigee as the basic parameter, are calculated for fixed and variable line of descent. Descent path length, g-loading, and altitude are plotted against time, and limit values for g-loading are given. To prevent narrowing of the reentry corridor by reduction in g-value, control of lift by two changeovers from maximum positive to maximum negative value is recommended for path lengths of 10000 km and by up to four changeovers for lengths of 5000 km. Author

N65-23677*# National Aeronautics and Space Administration, Washington, D. C.

PROBLEMS OF SPACECRAFT CONTROL DURING DESCENT IN THE ATMOSPHERE [PROBLEMY UPRAVLENIYA KOSMICHESKIM LETATEL'NYM APPARATOM PRI SNIZHENII V ATMOSFERE]

K. B. Alekseyev and G. G. Bebenin May 1965 57 p refs Transl. into ENGLISH from the book "Upravleniye Kosmicheskim Letatel'nym Apparatom" Moscow, Izd. Mashinostroyeniye, 1964

(NASA-TT-F-9336) CFSTI: HC $3.00/MF $0.50

The material is covered from the viewpoint of flight aerodynamics and vehicle control during descent. In the former the various classes of (nonboosted) descent trajectory are considered: ballistic, skip, and inertial glide. It is shown that the control system must correct alinement and magnitude errors, minimize overheating and dynamic overloading, compensate for nonstandard atmospheric conditions and wind disturbances, correct for rebounding when lift is utilized in descent, and augment the vehicle's natural pitch and yaw damping, which is negligible at hypersonic speeds. Guidance and control are investigated with respect to the communications, instrumentation, data processing, servo, and corrective subsystems required for meeting control objectives. A detailed analysis and systems synthesis in terms of individual controlled parameters give a qualitative picture of how to achieve integrated control of the total vehicle and its descent trajectory. Author

N65-23691*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

GUIDANCE OF A LOW L/D VEHICLE ENTERING THE EARTH'S ATMOSPHERE AT SPEEDS UP TO 50,000 FEET PER SECOND

Henry C. Lessing and Robert E. Coate Washington, NASA, May 1965 34 p refs

(NASA-TN-D-2818) CFSTI: HC $2.00/MF $0.50

A guidance scheme developed for use during the atmospheric reentry phase of fixed-trim, roll-modulated, $(L/D)_{max} = 0.5$ vehicle is basically a reference trajectory type of guidance. Below circular velocity a fixed reference trajectory is used, but during the most critical portion of the reentry at supercircular speeds the guidance continuously recomputes a reference trajectory dependent on the state of the vehicle. The scheme is capable of handling velocities from satellite reentry to those expected at return from the manned Mars mission which utilizes the Venus swing-by mode (50 000 feet per second). For parabolic and higher velocities, the guidance scheme is capable of controlling the vehicle to ranges of 1500 to 11 000 nautical miles. Reentry at angles corresponding to the extremes of the corridor defined by the vehicle capability can be handled in the presence of large variations of atmosphere density and realistic control dynamics. Author

N65-23697*# Geonautics, Inc., Washington, D. C.

STUDY OF SELENODETIC MEASUREMENTS FOR EARLY APOLLO MISSION Final Report

Bernard A. Claveloux et al 22 Jan. 1965 327 p refs (Contract NAS9-2803)

(NASA-CR-62654) CFSTI: HC $7.00/MF $1.75

This study investigated types of measurements and experiments during early Apollo missions to refine present estimates of size and shape of the moon, establish a selenodetic datum and the beginnings of a selenodetic control network, and establish horizontal and vertical control for improved lunar mapping. Measurements were investigated that could be obtained from lunar surface survey operations, from maximum utilization of Lunar Orbiter photography, and from observations using onboard equipment of the CSM, actually, the space sextant. Theory, equipment, operational methodology, and data reduction procedures applicable to these techniques and their objectives are set forth, along with estimated accuracies of results. Some procedures recommended will result in immediate benefits to selenodesy, others will become significant only with repeated landings and more extended coverage, and some will provide ground work and experience for learning what can or should be done during extended missions. Consideration was given to the astronaut's capabilities and his presence on the lunar surface or in the CSM. All recommended measurements can be made better and more accurately because of his presence. Author

N65-23705*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.

FEASIBILITY STUDY OF THE ULTRAVIOLET SPECTRAL ANALYSIS OF THE LUNAR SURFACE

Norman N. Greenman, Valerie W. Burkig, H. Gerald Gross, and J. Fred Young Mar. 1965 74 p refs (Contract NAS9-3152)

(NASA-CR-65005; SM-48529) CFSTI: HC $3.00/MF $0.75

Reflectance and luminescence characteristics in the 2000 to 3000 Å range of granite, gabbro, and serpentinite samples, in solid and granular form, were studied to determine feasibility of mapping the surface composition of the moon by spectral analysis from a manned lunar orbiting vehicle at 8- to 80-miles altitude. Luminescence was excited by ultraviolet radiation, X-rays, protons, and electrons. Results obtained were combined with available knowledge of the space radiation environment of the moon. It is concluded that, on the sunlit side of the moon, nearly all luminescence is due to ultraviolet excitation, is intense enough to be detected, and can be detected against the high reflected background by comparing the ratio of depth to continuum of a Fraunhofer line from the solar and lunar spectra. On the dark side no background of 2000 to 3000 Å light is present, but the luminescence from X-rays, protons, and electrons is at or below present detectability limits unless, as is possible, more energy is available from these sources than is estimated; in this case, the luminescence can be detected by directly viewing the lunar surface with a sensitive phototube. Compositional differences appearing in the experimental work are deemed detectable from the lunar orbiting vehicle and can be even more valuable when they are tied in with laboratory luminescence tests on rock samples returned from lunar landings. Author

N65-23706*# Army Corps of Engineers, Washington, D. C. Army Map Service

GEMINI CELESTIAL DISPLAY DEVICE STUDY Final Report

1 Mar. 1965 92 p

(NASA Order T-27508-G)

(NASA-CR-65006) CFSTI: HC $3.00/MF $0.75

This report discusses the finalized design of a celestial navigation device. It contains concise summaries of all engineering computations used in the design. The device is described, and its basic design principles are defined. How the principles are applied to support the planning and fabrication of the device is explained. Author

N65-23727# Grumman Aircraft Engineering Corp., Bethpage, N. Y.

TORSIONAL DYNAMICS OF AN AXIALLY-SYMMETRIC TWO-BODY FLEXIBLY-CONNECTED ROTATING SPACE STATION

Fred Austin Jan. 1965
(ADR-06-15-64.2)

The dynamic characteristics of a rotating space station, which can be analytically represented by two concentric flexibly connected bodies of revolution, are discussed. In the ideal system considered, the relative motion of the members is restricted to torsional rotation about the axis of revolution. Viscous damping effects are included as an expedient approximation to the true structural damping effects. Exact solutions to the differential equations of free motion are developed and, in addition, the system response to impulse torques is discussed. As in the case of a gyroscope, the motion may be described by a uniform precession of the axis of revolution about the angular momentum vector. The spin velocity of each member is composed of a constant component and a harmonic transient portion, which is multiplied by an exponentially decaying amplitude. Author

N65-23730 Royal Observatory, Edinburgh (Scotland).
THE PLEIADES, VOLUME 3, NO. 7
F. Ahmed, L. C. Lawrence, and V. C. Reddish HMSO, 1965 74 p refs HMSO: 15s

Methods of separation of cluster from field stars used by Hertzsprung, Johnson and Mitchell and Herbig are reviewed and shown inadequate. Additional information about the distribution of field stars in magnitude and color is provided by UBV photometry of 3000 stars in the region of the cluster. The 100 stars fainter than V = 13 with proper motions compatible with cluster membership are rephotometered, with attention to the effects of nebulous fog on the measures. Field and cluster stars are then separated by examining the distribution in X, Y, U, B, V, $\mu\alpha$, $\mu\delta$. The main sequence is at least 13 magnitudes long and intrinsically narrow, the r.m.s. dispersion about a mean line at the faint end being only $0^m.07 \pm 0^m.07$. The main sequence does not bend downwards at faint magnitudes. There is no contraction sequence. Author

N65-23736# Royal Aircraft Establishment, Farnborough (England).
A TRANSFER MANOEUVRE BETWEEN TWO NON-COPLANAR ELLIPTIC ORBITS [MANEVR PEREKHODA MEZHDU DVUMYA NEKOPLANARNYMI ELLIPTICHESKIMI ORBITAMI]
M. M. Nitse Feb. 1965 22 p refs Transl. into ENGLISH from Rev. Mecan. Appl. Acad. Rep. Populaire Roumaine (Rumania) v. 8, no. 6, 1963 p 1039–1055
(RAE-LIB-TRANS-1097)

The maneuver required to change transformation of the plane of an elliptic orbit while retaining the shape of the orbit is described, on the assumption that the thrust/mass ratio of the satellite is constant, and that the direction of thrust of the engine is fixed in space. An analysis is made of the maneuver in which the satellite, under the action of this engine, assumes uniform circular motion in a plane which does not include the earth's center O. Formulas for the variation of the positional elements of the final orbit are set up, and it is shown that the direction of the plane of the maneuver, and the thrust of the engine are determined by the eccentricity of the initial orbit, two types of maneuver being possible for each orbit with a specific eccentricity. The maximum values of the inclination of the final orbit are determined from analysis of the results obtained. Author

N65-23739*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A TECHNIQUE FOR OPTIMUM FINAL VALUE CONTROL OF POWERED FLIGHT TRAJECTORIES (REVISION NO. 1)
C. G. Pfeiffer 1 May 1965, 20 p refs
(Contract NAS7-100)
(NASA-CR-62722; JPL-TR-32-447) CFSTI: HC $1.00/MF $0.50

A technique is described for steering a rocket vehicle to thrust termination where the objective is to minimize the sum of the squares of the variations of the standard burnout conditions. The analysis is based upon a geometrical interpretation of an optimal trajectory, which is constructed from a simplified mathematical model of the motion of the vehicle. It is shown that there is an envelope of reachable points in the space of boundary condition variations and that the control (steering) to be applied can be found by dropping a perpendicular to this envelope. An example of ascent guidance into near-earth satellite orbit is worked out in detail, and numerical results are presented. It is shown that the control scheme is stable at the final time, and the relationship to the well-known velocity-to-be-gained steering scheme is pointed out. Author

N65-23796*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SA-8 OPERATIONAL TRAJECTORY
Pamelia B. Pack and Gordon W. Solmon 17 May 1965 48 p refs
(NASA-TM-X-53262) CFSTI: HC $2.00/MF $0.50

The trajectory for SA-8 was optimized to insert the S-IV stage and payload into an elliptical orbit with perigee and apogee altitudes of 510 km and 754 km, respectively; the orbit's predicted nominal lifetime is 1200 days. The S-I stage pitch program was shaped to minimize the angle of attack through the region of high dynamic pressure under nonwind conditions. The S-IV stage uses the iterative guidance mode to guide an optimum path in the pitch plane and the delta minimum mode for cross range guidance. The S-I booster will propel the vehicle to an altitude of 89 km with a range of 81 km. Orbital insertion occurs at 638.58 sec from liftoff. Conditions at time of insertion are these: velocity, 7675.18 m/s; path angle (inertially referenced from the local vertical), 90.000°; initial perigee altitude, 506.5 km; and corresponding apogee altitude, 751.2 km when referenced to a spherical earth of 6378.165 km. Author

N65-23799*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.
VENUS AND MARS NOMINAL NATURAL ENVIRONMENT FOR ADVANCED MANNED PLANETARY MISSION PROGRAMS
Dallas E. Evans, David E. Pitts, and Gary L. Kraus Washington, NASA, 1965 52 p refs
(NASA-SP-3016) CFSTI: HC $2.00/MF $0.50

A compilation of numerical values for a nominal natural environment for application in studies for advanced manned planetary missions to Venus and Mars is presented. The goal is to provide a standard environment as a base for the various missions and preliminary design studies, and to have a common basis for comparison of end results. G.G.

N65-23800*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEMS OF COSMOGONY, VOLUME VIII
V. A. Ambartsumyan et al May 1965 265 p refs Transl. into ENGLISH by Electro-Optical Systems, Inc. of the book "Voprosy Kosmogonii, Tom VII" Izd. Akad. Nauk SSSR, Moscow, 1962
(NASA-TT-F-119) CFSTI: HC $6.00/MF $1.50

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N65-23801* National Aeronautics and Space Administration, Washington, D. C.

PROBLEMS OF EXTRAGALACTIC RESEARCH

V. A. Ambartsumyan *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 2–26 (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

Basic results of recent studies of extragalactic objects are reported. The phenomenon of superposition of subsystems inside galaxies is considered in detail in connection with a cosmogonical interpretation. Attention is paid to the role of galactic nuclei as the centers of cosmogonical activity. Extremely high cosmogonical activity of central nuclei in supergiant galaxies is emphasized. One of the phenomena which resulted from this activity is the radio galaxies. The superposition of subsystems in clusters of galaxies is also discussed. A number of problems with which astronomers are faced in the field of extragalactic research are enumerated. Author

N65-23802* National Aeronautics and Space Administration, Washington, D. C.

ON SOME ASPECTS OF AMBARTSUMYAN'S HYPOTHESIS ON THE ORIGIN OF GALAXIES

B. A. Vorontsov-Velyaminov *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 27–31 (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

A discussion of the pros and cons of Ambartsumyan's hypothesis concerning the origin of galaxies, is presented. Data are included on the orgin of double galaxies, the probability of capture among isolated galactic fields in which interacting galaxies are numerous, the instability of clusters in groups and their positive energy, the instability and youth of systems of the Trapezium type, the prolonged existence and significant stability of elliptical galaxies entering into chains and in the Trapezia, the origin of energies necessary for the dispersion of parts of the divided nucleus of the galaxy having a velocity of hundreds of kilometers per second, the specific role of nuclei, the development of the spiral structure, and the phenomena of destruction of the facade. S.C.W.

N65-23803* National Aeronautics and Space Administration, Washington, D. C.

INVESTIGATION OF DISTANCES, MOTIONS AND DISTRIBUTION OF GALAXIES IN A SPHERE WITH A RADIUS OF 15 MEGAPARSECS

Yu. P. Pskovskiy *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 32–47 refs (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

Modulus of distance M 31, determined by Cepheids in the presence of a new zero-point, and the relation period luminescence of the Cepheids according to Arp is found equal to $23^{m}.95$. This agrees with evaluations made in respect to novae, if the novae are weakened by absorption within the M 31 is considered. Spatial distribution of galaxies within an area with a radius of 15 megaparsecs is considered by simple diagrams. This distribution confirms the existence of a galactic cloud with a central concentration in the Virgo cluster (hypergalaxy). The Fornax Cluster is not a hypergalaxy, but only an arm of our hypergalaxy. Character of motion in the hypergalaxy was investigated according to the red shift of 370 galaxies. The principal values of the tensor of the speed of deformation were found. De Vaucouleurs' model on the rotation of a complex of galaxies around one axis is descriptive, but very rough. There does not exist a single axis of galactic rotation. A galaxy rotates around a central plasma along chaotically oriented orbits. The motions within a hypergalaxy very much resemble that of a cluster. Author

N65-23804* National Aeronautics and Space Administration, Washington, D. C.

THE INTERACTION OF THE GASEOUS COMPONENTS OF GALAXIES AND RADIO GALAXIES WITH AN INTERGALACTIC MEDIUM

N. S. Kardashev *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 48–62 refs (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

Data on an intergalactic medium are explained. New observation data on the deformation of galactic planes on a wavelength of 21 cm are given. Various interpretations of this effect are discussed. This effect can be explained by an interaction with an intergalactic medium (hypothesis of Kahn and Woltjer). The problem on the interaction of extended radio galaxies with intergalactic matter is presented. Author

N65-23805* National Aeronautics and Space Administration, Washington, D. C.

ON THE GRAVITATIONAL PARADOX

A. Ya. Kipper *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 63–110 (Se N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

An attempt is made to solve the Poisson equation without establishment of boundary conditions. The Poisson equation is usually solved by means of the integral

$$\Omega = \lim_{\nu \to 0} \left\{ \varkappa \int_{(\nu)} \rho(\xi) \frac{d^3\xi}{|x-\xi|} \right\} = \varkappa \int_{(\infty)} \rho(\xi) \frac{d^3\xi}{|x-\xi|}$$

The divergence of this integral signifies that it does not have a numerical value; however, for certain problems of a cosmological nature, these integrals can be utilized. The divergent integrals are used as a result of the generalization in the concept of integrals which have an infinitely extensive integration. The generalized integral is

$$\int_{(\nu_\infty)} \rho(\xi) \frac{d^3\xi}{|x-\xi|}$$

and is known as an integral having an actually infinite extent of integration. It is stressed that the procedure of calculating the limit according to the first formula is not included in the determination of the integral. A physical interpretation of results obtained utilizing this method is presented. It has been shown that two systems of measuring space and time (gravitational and atomic) should exist. A study of equations of motion in which the coordinates are represented in generalized integrals only is also included. S.C.W.

N65-23807* National Aeronautics and Space Administration, Washington, D. C.

REVIEW OF CONTEMPORARY DATA CONCERNING THE MOON

B. Yu. Levin and Ye. L. Ruskol *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 127–169 refs (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

Contemporary data concerning the motion of the moon, its atmosphere, photometric characteristics, surface temperature, nature of the surface layer, relief, origin of the moon, its thermal history and internal structure are reviewed. Author

N65-23808* National Aeronautics and Space Administration, Washington, D. C.

ON THE PROBLEM OF THE MOON'S INNER STRUCTURE

S. V. Kozlovskaya *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 170–176 refs (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

Models made of ordinary silicates characteristic for the earth and meteorites are calculated. These models are in two groups: homogeneous models and those with a lighter crust, constituting 5%, 10%, and 15% by their mass, for two values of compressibility. The decrease of the moon's density as a result of heating up of the interior, and the decrease of the values of compressibility and the coefficient of thermal expansion are evaluated. Under these conditions, there is either a stable or an unstable model. The inner structure of the moon is approximated by the two-layer model, with a shell inhomogeneous in composition but constant in density. An attempt is made to discover which deductions can be drawn concerning the inner structure of the moon, on the basis of present data on the properties of rock formations and on the thermic history of the moon. Author

N65-23809* National Aeronautics and Space Administration, Washington, D. C.

ON THE PROBLEM OF THE ROTATION OF PLANETS

V. S. Safronov *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 177–197 refs (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

Explanation of the rotation of planets based on the theory that planets were formed through a junction of solid particles and bodies of a protoplanetary cluster is analyzed. An analysis of the equation for energy and momentum balance of the amount of motion, revealed the inadequacy of the simplified system considered, i.e., the system which suggests that the particles of the cluster traveled along circular orbits. The condition of direct rotation is not fulfilled in this system at the present rotation speed of the earth, which would have to increase 10^4 times to fulfill it. The angular energy momentum equations for a more general case of the motion of bodies in elliptical orbits are deduced. In this new model previous contradictions are eliminated. Relation between planet rotation and heat losses during formation is analyzed. A revision of the former concept of that relation is dictated by consideration of the planet's rotation energy. It has been shown that the heat losses diminish with the increase of speed of rotation. Author

N65-23810* National Aeronautics and Space Administration, Washington, D. C.

ON THE DISPERSION OF VELOCITIES IN ROTATING SYSTEMS GRAVITATING BODIES WITH INELASTIC COLLISIONS

V. S. Safronov *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 198–211 refs (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

The energy increase of irregular motion in a system of gravitating bodies of identical masses m and radii r with a differential rotation is evaluated by determining the heating of viscous medium in the presence of a velocity gradient. The expression for quantity of liberated energy applied in rotating systems having a great mean free path is derived. The inelastic collisions of bodies decrease the energy of irregular motion more than the relative velocities. From the conditions of the equality of the emitted and absorbed energy of irregular motion, the expression was derived for the (equilibrial) relative velocity of bodies in the system. This velocity has practically the same character of dependence on m and r as an equation found earlier ($v^2 \propto Gm/r$). The coefficient of proportionality is determined by the degree of inelasticity of collisions, and depends upon the parameter connected with the characteristics of the energy and momentum transfer in rotating systems with a long duration of free flight. The numerical value of this parameter is not accurately known. Author

N65-23811* National Aeronautics and Space Administration, Washington, D. C.

A BRIEF REVIEW OF RESEARCH ON MORPHOLOGICAL CHARACTERISTICS OF DIFFUSE NEBULAE

R. Ye. Gershberg *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 212–227 refs (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

Investigations of morphological characteristics of diffuse nebulae are reviewed. The fundamental physical ideas connected with the interpretation of three types of structural details of diffuse nebulae are examined: bright rings on the border of luminous and dark nebulae; peripheral structures of the emission nebulae; and stretched and fibrousness formations of luminous and dark diffuse nebulae. Author

N65-23812* National Aeronautics and Space Administration, Washington, D. C.

ELECTRON TEMPERATURE OF GASEOUS NEBULAE AND METHODS OF ITS DETERMINATION

V. I. Pronik *In its* Probl. of Cosmogony, Vol. VIII May 1965 p 228–260 refs (See N65-23800 13-30) CFSTI: HC $6.00/MF $1.50

Works on the investigation of energy balance and the determination of the electron temperature in the gaseous nebulae are considered. A review is given of the methods of the determination of the electron temperature from the observations.

Author

N65-23820*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANALYTICAL LIFETIME STUDIES OF A CLOSE-LUNAR SATELLITE

William R. Wells May 1965 41 p refs

(NASA-TN-D-2805) CFSTI: HC $2.00/MF $0.50

An analytical study was made to determine the influence of the third zonal harmonic of the moon on the lifetime of close-lunar satellites. The lunar model used has oblateness, equatorial ellipticity, and a nonsymmetric distribution of mass in the Northern and Southern Hemispheres; that is, the gravitational potential function includes terms involving the coefficients of the zonal and sectorial harmonics J_{20}, J_{22}, and J_{30} in addition to the point-mass contribution. Target-site selection for a photographic mission is considered for orbits with initial arguments of pericentron corresponding to optimum lifetimes based on a given magnitude of J_{30} (independent of its sign). With this constraint imposed on the initial argument of pericentron, the effect of inclination on the target sites and rate of change of pericentron altitude is considered. This phase of the analysis is considered by using several values for the magnitude of J_{30}. (Pericentron is defined as the point in the orbit of one body about another at which the least separation of the two bodies occurs.)

Author

N65-23822*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ROTATING GALACTIC ARMS AND LEADING-EDGE SHOCK WAVES IN H III

Robert E. Davidson May 1965 17 p refs

(NASA-TN-D-2810) CFSTI: HC $1.00/MF $0.50

A steady-state galactic-structure theory based on magnetohydrodynamic principles was developed. Quasi-steady states, however, are not excluded. The theory provides an energy source for the coronal heating called for in the theories of Pickelner and Spitzer. The magnitude of the energy source can be calculated. To agree with other knowledge of spiral galaxies it is necessary to assume that spiral arms are shaped by supersonic drag with attendant shocks. The angular motion of the galactic arms through the gas in the disk produces a flow over the arms which is subsonic within a certain distance of the galactic center and is supersonic outside it. From resulting aerodynamic effects an explanation of important galactic phenomena can be made.

Author

N65-23828*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

DETERMINATION OF DESIGN METEOROID MASS FOR A SPORADIC AND STREAM METEOROID ENVIRONMENT

Donald J. Kessler and Robert L. Patterson May 1965 28 p refs

(NASA-TN-D-2828) CFSTI: HC $2.00/MF $0.50

Although meteor influx rates vary throughout the year, the total meteor activity can be represented as a fairly constant sporadic background with periods of increased activity associated with meteor streams. For a given probability of impact, the design meteoroid mass is a function of the meteoroid flux, the exposed area, and the time spent in the environment. A method is developed to compute the design mass for exposure to a specified meteoroid environment.

Author

N65-23891# Instituto y Observatorio Astronomico de Marina, San Fernando (Spain).

AERONAUTICAL ALMANAC, MAY, JUNE, JULY, AUGUST, 1965 [ALMANAQUE AERONAUTICO, MAYO, JUNIO, JULIO, AGOSTO, 1965]

1965 273 p In SPANISH

N65-23897# Smithsonian Astrophysical Observatory, Cambridge, Mass.

POSSIBLE EFFECTS OF NUCLEAR FORCES ON THE DYNAMICAL STABILITY OF NEUTRON STARS

Sachiko Tsuruta [1965] 8 p refs

Results of recent calculations which show how various possible forms of the nuclear potential affects the general behavior of stability in high density objects are presented. For stars to be stable they must first be in hydrostatic equilibrium. Models were, therefore, constructed by solving the general relativistic equations of hydrostatic equilibrium. The dynamical stability of these models was estimated by the variational principle. According to this principle, a sufficient condition for the occurrence of dynamical instability is that the square of the circular frequency of a radial oscillation be negative. When the stellar density approaches the normal nuclear density of 3.7×10^{14} g/cc, the constituent particles generally experience attractive forces, but as the density increases further repulsive forces eventually predominate. To examine the effect of these forces, three different nuclear potentials were chosen. It was found from these calculations that the square of the circular frequency oscillates as a function of central density and approaches a finite value after a number of damped oscillations as the central density goes to infinity.

E.E.B.

N65-23950# European Space Vehicle Launcher Development Organization, Paris (France).

ORBITAL PRECISION AS A FUNCTION OF INSTRUMENTAL PRECISION (GENERAL FORMULAS AND APPLICATION TO CIRCULAR POLAR ORBITS) [PRECISION D'ORBITE EN FONCTION DE LA PRECISION INSTRUMENTALE (FORMULES GENERALES ET APPLICATION AUX ORBITES CIRCULAIRES POLAIRES)]

E. Cambi Aug. 1964 34 p In FRENCH

(ELDO-TM-F-2)

General equations which correlate the values of the six orbital parameters to coordinates measured at injection are established, and the sensitivity of the different parameters to measurement errors is deduced. The general formulas are applied to the particular case of circular polar orbits, and numerical values are given for an orbit of 500 km.

Transl. by M.P.G.

N65-23958# Eurospace, Paris (France).

MINUTES OF THE TECHNICAL MEETINGS HELD DURING THE EUROSPACE CONFERENCE IN BRUSSELS ON THE SPACE TRANSPORTER

Maurice Roy [1964] 32 p Conf. Held 23–24 Jan. 1964

(Rept.-6525)

The presented minutes contain annotated versions of speeches and communications pertaining to European Space Transporter. Discussed were a general mission analysis; some basic aspects of an aerospace plane transporter; the possible design of a space transporter; structure problems of space systems; methods and required data in heat shield design; compared costs of space transporters and booster rockets; cost

considerations for the space launch vehicle; electronics; recovery of space transporters with flexible wings; the space rotorcraft; personnel subsystem; comparative methods of space boosting; adaptation of conventional air-breathing engines to the propulsion of the first stage of a space transporter; considerations of rocket propulsion for an aerospace vehicle; and high pressure rocket power units for space transporters. G.G.

N65-23972# Sud-Aviation, Paris (France).
STUDY OF ENVIRONMENTAL EFFECTS AND TORQUE ACTION OR TORQUE IMPULSIONS ON THE ATTITUDE OF A SATELLITE IN ROTATION [ETUDE DES EFFETS DE L'ENVIRONNEMENT ET DE L'ACTION DE COUPLES OU D'IMPULSIONS DE COUPLE SUR L'ATTITUDE D'UN SATELLITE EN ROTATION]
Aug. 1963 46 p In FRENCH

An inventory of parasitic coupling factors, arranged according to order of magnitude, and regrouping of formulas of the mechanical reasoning which rule, to the first order, the changes of attitude of a satellite in response to a gyroscopic movement are presented. A concrete case is considered, in a simple and classical manner to begin with, in which a monolithic cylindrical satellite is turned by four paddles deployed in the form of a cross at right angles to each other, and whose axes of symmetry should be pointed directly at the sun within a few minutes of arc. The orbital conditions of reference are naturally those which are beginning to become well known in France in the Diamant program. The attitude control torque is assumed to be provided with jets; the correction process envisioned consists of a systematic readjustment of 2 minutes of arc in the appropriate direction each time the variation reaches that value. Transl. by M.P.G.

N65-24022# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SECOND CATALOG OF HOURLY METEOR RATES
Charles P. Olivier Washington, D. C., Smithsonian Inst., 1965 13 p refs *Its* Smithsonian Contributions to Astrophysics, Vol. 8, No. 6 GPO: $0.20

Data for the interval 1958 to 1963 are included, as well as some material for 1964. This catalog is based almost entirely on work done in the United States and Japan; less than one percent came from the Southern Hemisphere and Europe. Data on observations made during the Perseid epoch, and the Leonid epochs are included. Atypical data were omitted. Rates published are higher (20%) than the rates of meteors an observer will actually see, unless he is counting under ideal atmospheric conditions. The figures given represent the number of meteors that might have been counted by a skilled observer at a good station on a moonless, clear night when factor F was equal to 1.0. Under conditions that fall short of this ideal, the number of meteors actually observed will usually be smaller than the number given in the table. S.C.W.

N65-24052# British Aircraft Corp., Stevenage (England). Guided Weapons Div.
RENDEZVOUS AND DOCKING
E. M. Dowlen and J. Seddon [1963] 30 p refs Presented at Brit. Interplanet. Soc. Symp. on "Aerospace Vehicles", Northampton Coll., London, 13 Nov. 1963

Rendezvous in earth orbits are principally considered. The following topics are discussed: purposes of rendezvous, phases of rendezvous, methods of orbital transfer, launching and ascent, terminal phase, manned control of terminal phase, docking phase, guidance considerations, and injection into stationary orbit. An extensive bibliography is included in the survey. S.C.W.

N65-24062# National Space Activities Council, Tokyo (Japan).
JAPAN'S SPACE PROGRAMS FOR 1964
Terutaka Akutagawa May 1964 24 p

Japan's space program is described and a cost and budget breakdown for space research is given. The responsibilities are delegated to several agencies, which include the Science and Technology Agency, the Ministry of Education, the Ministry of International Trade and Industry, the Ministry of Posts and Telecommunications, and the Ministry of Construction. The purposes and roles of the agencies in the space program are outlined, and cost breakdowns are given for the particular areas of research with which they are concerned. C.L.W.

N65-24091 Royal Greenwich Observatory, Herstmonceux (England).
DIFFERENTIAL CURVE-OF-GROWTH ANALYSES OF SOME COOL STARS
B. E. J. Pagel London, HMSO, 1964 58 p refs *Its* Bull. No. 87 HMSO: 8s

A new method is described of differential curve-of-growth analysis for cool stars. The value of $\Delta\theta$ (which is identical for both excitation and ionization), and the shape of the curve of growth, are determined by an iterative procedure based on a comparison of the differences between the abscissa of any line on the stellar curve of growth and the abscissa of the same line on the solar curve of growth, for lines having various excitation potentials. The resulting values of $\Delta\theta$ are shown to agree with values derived for the continuum from six-color photometry, where such measurements are available; this confirms the basic assumption of the theory, namely that $\Delta\theta$ is virtually independent of optical depth. The turbulent velocity, which is difficult to determine from equivalent widths of only moderate accuracy, is eliminated from the analysis. The observational material consists of plates in the blue region with dispersions of 4.5 A/mm or 9 A/mm, taken at Mount Wilson Observatory in 1961 October and November. Author

N65-24092 Royal Greenwich Observatory, Herstmonceux (England).
DOUBLE-STAR OBSERVATIONS MADE WITH THE 28-INCH REFRACTOR 1960–1963
Richard Woolley, L. S. T. Symms, D. H. P. Jones, and M. P. Candy London, HMSO, 1964 32 p refs *Its* Bull. No. 88 HMSO: 4s 6d

This is the second list of double-star observations made with the 28-inch refractor and comprises 1334 observations of 233 pairs. All measures of position angle were made with the filar micrometer, and separations were measured with the comparison image micrometer with a few exceptions. A separate table presents a comparison of the present observations with current orbits. G.G.

N65-24095 Royal Greenwich Observatory, Herstmonceux (England).
FUNDAMENTAL DATA FOR SOUTHERN STARS (FIFTH LIST)
David S. Evans, J. D. Laing, A. Menzies, and R. H. Stoy London, HMSO, 1964 22 p refs *Its* Bull. No. 85 HMSO: 3s

Observations of radial velocity, magnitude, colors and spectral type for 300 southern stars are presented. The emphasis is on nearby stars and subdwarfs. For 66 of the dwarf stars without relatively bright companions, space coordinates and motions relative to the sun were computed, mostly using photometric parallaxes. Author

N65-24105*# National Aeronautics and Space Administration, Washington, D. C.
ON THE INTERPOLATIVE ANOMALIES FOR THE FIRST TEN MINOR PLANETS [OB INTERPOLYATSIONNYKH ANOMALIYAKH DLYA PERVYKH DESYATI MALYKH PLANET]
M. Yarov-Yarovoy Jun. 1962 33 p refs Transl. into ENGLISH from Tr. Gos. Astron. Inst. (Moscow), v. 24, 1954 p 17–39 (NASA-TT-F-8237) CFSTI: HC $2.00/MF $0.50

The scheme of the restricted circular problem of three bodies—Sun, Jupiter, and asteroid—where the Sun is the perturbing body and the asteroid is the perturbed body, was used to occultate elements of the orbits of the first 10 asteroids. The values of the anomalies were interpolated from the mean anomaly for the various moments of time of the asteroid; from the angular distance of the perihelion from the node; and from the node's longitude. The constructed interpolative anomalies were compared to the Delaunay anomalies of minor planets and showed more constant quantities than the latter. G.G.

N65-24107# Royal Aircraft Establishment, Farnborough (England).
PERTURBATIONS OF SATELLITE ORBITS BY TESSERAL HARMONICS IN THE EARTH'S GRAVITATIONAL POTENTIAL
G. E. Cook London, Min. of Aviation, Oct. 1962 36 p refs (RAE-TN-SPACE-19)

Effects of tesseral harmonics, which express the variation of the earth's gravity with longitude, are investigated. Long-period variations due to these harmonics up to the fourth degree are determined for orbits of any inclination and any eccentricity. Author

N65-24140* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CHARACTERISTIC FEATURES OF SOME PERIODIC ORBITS IN THE RESTRICTED THREE-BODY PROBLEM
Wilton E. Causey *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 110–118 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

Presented are earth–moon orbits which, when referred to a rotating coordinate system, return periodically to their original set of state variables. Such orbits offer repeated approaches to both earth and moon and could be used for instrumented exploration of earth–moon space for meteoroid concentration, radiation belts and other useful information. Author

N65-24141* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RECENT DEVELOPMENTS IN THE PREDICTION OF EARTH ORBITAL SATELLITE LIFETIME
H. F. Kurtz, Jr. and A. R. Mc Nair *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 119–123 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

A brief review of the orbital lifetime prediction model currently in use followed by discussion of two recent developments in lifetime studies. The first is an extension of graphical prediction charts to account for the effects of orbital inclination, argument of perigee, and date of launch. The second is a method of joint optimization of orbital lifetime and payload mass placed in orbit by a given vehicle. It is found by the latter method that significant increases in lifetime or payload mass may be obtained through the selection of an optimum elliptical orbit. Author

N65-24184*# Arizona Univ., Tucson. Lunar and Planetary Lab.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 2, NO. 36–39
Gerard P. Kuiper 1964 73 p refs
(Grant NsG-161-61)
(NASA-CR-62820) CFSTI: HC $3.00/MF $0.75

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1. RADIAL STRUCTURES SURROUNDING LUNAR BASINS. II: ORIENTALE AND OTHER SYSTEMS; CONCLUSIONS W. K. Hartmann p 175–191 refs (See N65-24185 13-30)

2. COMPARISON OF THE INFRARED SPECTRUM OF MARS WITH THE SPECTRA OF SELECTED TERRESTRIAL ROCKS AND MINERALS Alan B. Binder and Dale P. Cruikshank p 193–196 refs

3. ON THE DISTRIBUTION OF LUNAR CRATER DIAMETERS William K. Hartmann p 197–203 refs

4. ANALYSIS OF LUNAR LINEAMENTS. I: TECTONIC MAPS OF THE MOON R. G. Strom p 205–216 refs (See N65-24186 13-30)

N65-24185* Arizona Univ., Tucson. Lunar and Planetary Lab.
RADIAL STRUCTURES SURROUNDING LUNAR BASINS. II: ORIENTALE AND OTHER SYSTEMS; CONCLUSIONS
William K. Hartmann *In its* Communications of the Lunar and Planetary Lab. 1964 p 175–191 refs (See N65-24184 13-30) CFSTI: HC $3.00/MF $0.75

A new analysis of mare basins begun by Hartmann (1963) is concluded. The radial systems of the oldest basins are the least developed, while those of the young basins—Mare Imbrium and Mare Orientale—are the most prominent. It is therefore hypothesized that conditions for producing radial lineaments were optimum during the relatively short period when the mare basins were flooded. Many lineaments are spatially associated with this flooding. The basins are probably the sites of great impacts which were accompanied by radiating fractures. Most lineaments are interpreted as the expressions of tectonic adjustments in the stressed crust along these fractures as a result of heating of the subsurface. Most of the adjustment appears to be by vertical motion. There is little evidence for horizontal motion or for gouging of radial valleys by flying fragments. Reviews of the nonradial grid patterns and of the small radial systems around some recent craters are included. Author

N65-24186* Arizona Univ., Tucson. Lunar and Planetary Lab.
ANALYSIS OF LUNAR LINEAMENTS. I: TECTONIC MAPS OF THE MOON
Robert G. Strom *In its* Communications of the Lunar and Planetary Lab. 1964 p 205–216 refs (See N65-24184 13-30) CFSTI: HC $3.00/MF $0.75

Lineaments within 60° of the moon's center of face have been mapped in detail. Four global lineament systems and radial systems associated with four circular maria are delineated. The majority of polygonal crater rims, linear portions of central peaks, crater chains, and certain linear mare ridges are related to the lineament systems. Spatial relationships of the lineament systems and other data indicate that the global systems resulted from compressive stresses in the moon's crust which were oriented in a north–south direction. Possible causes of these stresses are (1) the gradual subsidence of the tidal bulge, (2) expansion and contraction of the moon, (3) lunar body tides, (4) convection currents within the moon as postulated by Runcorn, and (5) a shift of the moon's axis of rotation. Author

N65-24291*# National Aeronautics and Space Administration, Washington, D. C.
PHYSICS AND ASTRONOMY PROGRAMS: ORBITING ASTRONOMICAL OBSERVATORIES
Homer E. Newell 1965 20 p Statement presented before the Subcomm. on Space and Sci. and Appl., Comm. on Sci. and Astronautics, House of Representatives
(NASA-TM-X-56414) CFSTI: HC $1.00/MF $0.50

The role and importance of the Orbiting Astronomical Observatory (OAO) in studying the spectral regions of electromagnetic radiation in space are reviewed. The missions and capabilities of the OAO are assessed and the program is summarized. A brief outline of the OAO schedule is also given. C.L.W.

N65-24341# RAND Corp., Santa Monica, Calif.
REVIEW OF THE THIRD MANNED SPACE FLIGHT MEETING
Deane N. Morris Jan. 1965 22 p Submitted for Publication
(P-3051; AD-610281)

A synopsis of papers presented at the Third Manned Space Flight Meeting is given. Emphasized is the status of the Gemini Program, Lunar Program, Earth Orbital Program, and Interplanetary Program. Flight profile, mission objectives, configuration design, guidance and control systems, and system reliability, are among the data presented for each program. S.C.W.

N65-24352# Joint Publications Research Service, Washington, D. C.
ORIENTATION IN BOUNDLESS SPACE
G. Komendantov et al 26 May 1965 6 p Transl. into ENGLISH from Krasnaya Zyezda (Moscow), 25 Mar. 1965 p 3
(JPRS-30261; TT-65-31086) CFSTI: $1.00

An analysis of factors contributing to spatial disorientation during weightless flight is presented. Emphasized are the importance to the temporary impairment of spatial orientation of a balanced interaction between visual, vestibular, joint muscular proprioceptive, cutaneomechanical, and interoceptive sense organs; and the influence of mechanical stimuli caused by inertia, muscular activity, fatigue, and emotional stress. The use of carefully selected personnel and special training methods as alternating instrumental and visual control operations of the spacecraft, flying by the so-called Kepler parabola, and general and special physical exercises, is proposed for the prevention of spatial orientation impairment. S.C.W.

N65-24355*# RAND Corp., Santa Monica, Calif.
MARS ENVIRONMENTAL MEASUREMENTS IN SUPPORT OF FUTURE MANNED LANDING EXPEDITIONS
W. H. Krase Apr. 1965 48 p refs
(Contract NASr-21)
(NASA-CR-62872; RM-4437-NASA) CFSTI: HC $2.00/MF $0.50

Measurement techniques to obtain data before manned landing expeditions on Mars are presented for any manned landing; a manned landing using aerodynamic braking from orbit; a manned landing using aerodynamic braking from hyperbolic velocity; and a manned landing using a Mars-orbit-rendezvous flight profile with significant inclination of the rendezvous orbit. A substantially different probe flight profile has to be considered for aerodynamic braking from hyperbolic speed at Mars than that considered for scientific probes. Desirable measurements for unmanned probes in support of future manned landings pertain to atmospheric pressure and temperature; atmospheric density; altitude measurements by a radio altimeter in the lander vehicle; mass spectrometry with heat shield temperature instrumentation and filter radiometry of lander vehicle; surface load bearing capability; surface slope; winds; mapping; radius of Mars; and oblateness of Mars. G.G.

N65-24381*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
ANALYSIS OF MARS ENTRY WITH CONSIDERATION OF SEPARATION AND LINE-OF-SIGHT RELAY COMMUNICATION FOR BUS-CAPSULE COMBINATIONS
E. Brian Pritchard and Edwin F. Harrison Washington, NASA, May 1965 72 p refs
(NASA-TN-D-2841) CFSTI: HC $3.00/MF $0.75

An analytical study of the deceleration loads, stagnation-point heating, communication time after blackout, and parachute-deployment conditions encountered during Mars atmospheric entry was conducted for several Mars model atmospheres with surface pressures from 10 to 40 millibars. The requirements for separation and line-of-sight relay communication for the combinations of a flyby bus and entry capsule were studied in terms of capsule aerodynamics, Martian atmospheric structure, separation distance, bus periapsis distance, hyperbolic excess velocity, and the angle at which the separation-velocity increment was applied. The results indicate that for a vertical entry requirement the maximum allowable value of the ballistic parameter is less than 0.2 slug/ft^2 for unmanned ballistic entry vehicles capable of either communication with the Earth between blackout and Mars impact for 60 seconds or a soft landing with parachute-deployment velocities of 1000 fps or less. The utilization of a vehicle with a lift-drag ratio of 0.5 was shown to allow a significant increase in the maximum allowable ballistic parameter to values of about 0.3 slug/ft^2. Separation of the entry capsule from the flyby bus at a distance of 300 Mars radii from the planet requires a separation-velocity increment from about 100 to 300 fps. For steep entry, an effective line-of-sight communication can be maintained from the end of blackout to capsule impact with an increase in the separation-velocity increment of about 15 fps or less. A large increase in this velocity is shown to be required for soft-landing vehicles requiring vertical entry with surface lifetimes of approximately 1 hour if a relay communications link is employed. This velocity increment is reduced by approximately two-thirds by employing shallow entry. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N65-23475*# National Aeronautics and Space Administration, Washington, D. C.
NASA TO LAUNCH SECOND PEGASUS METEOROID SATELLITE
17 May 1965 34 p
(NASA News Release-65-151) Available from the Scientific and Technical Information Division

Background information on the Pegasus B mission is presented. The primary purpose of this second Pegasus flight is to gather information on the frequency of meteoroids to be

encountered in the near-earth environment for use in design of future manned and unmanned spacecraft. Pegasus B flight will have orbital elements almost coinciding with those of the earlier Pegasus I. The satellite will be launched by the two-stage Saturn I (SA-8), and will be folded inside a service module in the Apollo Spacecraft. The launch vehicle, spacecraft, and satellite are described. The launch preparations and flight sequence are outlined. Pegasus tracking and data acquisition by means of on-board and ground-based radar and telemetry is discussed. Location and tracking method are listed for 35 stations in the worldwide network. Industrial participants and their activities in this program are identified. J.M.D.

N65-23476*# National Aeronautics and Space Administration, Washington, D. C.
NASA SCHEDULES FOUR-DAY MANNED GEMINI FLIGHT FROM CAPE KENNEDY
21 May 1965 92 p
(NASA News Release-65-158)

The National Aeronautics and Space Administration announces a two-man Gemini 4 mission that is scheduled to circle the earth for 4 days. The primary objectives of the Gemini 4 flight are (1) to demonstrate and evaluate the performance of the spacecraft systems for a period exceeding 4 days; and (2) to evaluate effects of prolonged exposure to the space environment of the two-man flight crew in preparation for flights of longer duration. The 11 planned experiments for this mission are discussed, and a detailed mission analysis together with background data is presented. G.G.

N65-23599# California Univ., Livermore. Lawrence Radiation Lab.
DEVELOPING A PAYLOAD FOR A HIGH-ALTITUDE DIAGNOSTIC ROCKET—MECHANICAL ENGINEERING ASPECTS
Henry L. Knoll, Karl Kiraly, and John Harri 1 Mar. 1965 55 p refs
(Contract W-7405-ENG-48)
(UCRL-12271) CFSTI: $3.00

The HAD (High Altitude Diagnostics) program was initiated by the High Altitude Physics Group for the development of a rocket payload capsule and recovery system that incorporated features found necessary during the previous high altitude test program associated with Dominic Operation. The desired payload capsule was to have an increased useful volume over the Dominic capsule and was to be designed for a high probability of recovery under adverse conditions. Within the limits of the HAD program, these objectives were met. Author

N65-23767# Sandia Corp., Albuquerque, N. Mex.
PROJECT SAND FINAL PROGRAM REPORT, VOLUME I
D. Q. Matejka and W. L. Wood Apr. 1965 57 p refs
(SC-RR-64-1793) CFSTI: $3.00

On the RY-15 sampler flight, all events were successfully completed through sampler spin-up and a few seconds of the actual sampling operation. The test was ended by a blade failure caused by resonant coupling between the gyroscopic nutational frequency of the blade and the first mode bending natural frequency of the blade structure. During the course of the program the following achievements were of special importance: (1) An inflatable torus applied to the sampler retardation parachute insured rapid and repeatable opening. (2) The retrorockets fitted with high-altitude igniters ensured operation at extreme altitudes. (3) The reliability was increased in retrorockets and the parachute system. (4) A baroswitch within the payload provided a backup deployment capability for the final recovery parachute. E.E.B.

N65-23927*# National Aeronautics and Space Administration, Washington, D. C.
NASA WILL LAUNCH THIRD INTERPLANETARY MONITORING PLATFORM
24 May 1965 21 p Press kit
(NASA News Release-65-164) Available from the Scientific and Technical Information Division

The National Aeronautics and Space Administration discusses the launching of the third Explorer satellite in the Interplanetary Monitoring Platform series. The new satellite will be launched by a three-stage Delta into a highly elliptical orbit which will take it 130000 miles into interplanetary space. It is designed to measure magnetic fields, cosmic rays, solar wind, and to study charged particles coming from the sun and from sources beyond the solar system. Results will contribute to the development of solar flare prediction capability which will be useful to the Apollo manned moon landing program. Detailed background information for this compact 130-pound laboratory satellite is presented. G.G.

N65-23934*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SATELLITES AND SOUNDING ROCKETS Goddard Projects Summary
[1964] 38 p
(NASA-TM-X-56397) CFSTI: HC $2.00/MF $0.50

A summary of Goddard Space Flight Center's satellite and space probe projects is presented in table form. Discussed are designation, objectives, launch and orbit data, project manager and project scientist, and experimental data for each project. Partial listings of scheduled satellite projects are included. Data of sounding rocket flights from 1959 through 1963 are also presented. G.G.

N65-23938# National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.
OPERATIONS REQUIREMENT FOR BLACK BRANT ROCKET AA-II-25: COSMIC RAY, LANGMUIR PROBE AND MICROMETEORITE LAUNCH FROM CHURCHILL RESEARCH RANGE
S. G. Jones and K. A. Steele Nov. 1963 54 p Revised
(ERB-639; OR-116)

The rocket was instrumented to measure various phenomena in the upper atmosphere associated with auroral activity, including cosmic-ray experiments concerned with the energy spectrum and direction of energetic particles, Langmuir probe measurements of the fine structure of electron density and energy spectra, and acoustic-type impact counter for micrometeorite detection. The rocket was directed into a visible auroral display under conditions of darkness, no cloud cover and no moon. Requirements for working space, transport, power, communications, meteorological and other scientific data, details of the telemetry used, and the data records required are given. A detailed countdown is also included. Author

N65-23962# British Aircraft Corp., London (England). Preston Div.
ENGINEERING PROBLEMS OF NEAR FUTURE HYPERSONIC VEHICLES
T. W. Smith [1964] 18 p Presented at Eurospace Conf., Brussels, 23–24 Jan. 1964

The various elements of the aerospace plane consisting of takeoff, boost, orbit, reentry, and landing are evaluated for their operation in future hypersonic vehicles. The development of a three-stage airbreather is found to be highly dependent on the achievement of low weight. The factors of flight

areas, surface protection, propulsion system penalties, ancilliary systems, and the choice of end stage speed are all discussed with their effect on the weight problem, and it was deduced that the percentage weight in orbit of the airbreather reduces the advantage obtained by speed. It was concluded that criterion for the choice of system as well as the variables of each system will be the overall cost. G.G.

N65-23963# United Aircraft Corp., Farmington, Conn. Corporate Systems Center

SPACE LAUNCH VEHICLE COST CONSIDERATIONS

J. C. Peters [1964] 17 p Presented at Eurospace Conf., Brussels, 23–24 Jan. 1964

The costs for development and operation of a typical air transportation system are contrasted with the costs associated with the development and operation of present missile and space vehicles. Costs for liquid hydrogen in production quantities were estimated at $0.25 and $0.50 per pound. Some of the more exotic storables were available in quantities for about $1 per pound. Under the present space system a typical program of 30 flight tests for massive-type vehicles proposed involves the expenditure of about $3 billion in vehicle structure alone. An operating factor considered was the cost associated with operation of the air transportation system. If an aircraft flies approximately 2000 hours/year, then the cost for all maintenance including replacement of engines, etc., is only 8.5% of the original cost of the aircraft. It is probable that a truly economical space transportation system need not have a thrust capability much greater than a few million pounds. Immediate efforts are recommended to determine true relationships between reliability, safety, and cost design philosophies if the United States is achieve any significant space program beyond Apollo. R.W.H.

N65-23964# Societe Anonyme Belge de Constructions Aeronautiques, Brussels (Belgium). Engineering Div.

THE SPACE TRANSPORTER—GENERAL MISSION ANALYSIS

Max A. Hauzeur [1964] 8 p Presented at Eurospace Conf., Brussels, 23–24 Jan. 1964

An analysis of the relative merits of a space transporter for manned satellites and interplanetary missions is presented. The advantages of the integral versatility and very broad development potential of its design, reliability, reduced cost per satellite pound, and maneuverability are discussed. The efficiency of a space transporter as an observation and high-altitude scientific laboratory, experimental vehicle for very high speed flight conditions, and training and instruction vehicle for astronauts is also considered. A comparative study is made between the basic features of a space transporter and a large conventional launcher. It is concluded that both designs complement rather than directly oppose each other. The feasibility of Europe's development of a space transporter to complement the American program of heavy launch vehicles is discussed. S.C.W.

N65-23966# General Electric Co., Philadelphia, Pa. Missile and Space Div.

RELIABILITY AND ENVIRONMENTAL TESTING OF SPACECRAFT

Hilliard W. Paige Paris, Eurospace, 19 Jun. 1964 16 p Presented at the U.S.–European Conf., Rome, 22–24 Jun. 1964

The philosophy of reliability and environmental testing in the space program is discussed, and the approach used in the Nimbus program is cited as an example of the working of this philosophy. The desirability of doing all practical prelaunch environmental testing on a complete spacecraft is emphasized; however, it is recognized that it is quite impossible to simulate all the necessary conditions of space. However, many of these conditions can and are being simulated. Among these are temperature, humidity, shock, vibration, acceleration, space vacuum, solar radiation, earth radiation, thermal shock, and combinations of these parameters. Further, it is observed that the environment of space is a hostile one—to both men and machines—but with proper planning, adequate management control, and the flight insurance offered by preflight testing, it can be successfully and reliably overcome. E.E.B.

N65-23969# Lockheed Aircraft Corp., Burbank, Calif.

TESTING OF BOOSTER UPPER STAGES

E. P. Wheaton Paris, Eurospace, [1964] 18 p Presented at the U. S.–European Conf., Rome, 22–24 Jun. 1964

To illustrate the philosophy, objectives, and the full scope of requirements for preflight testing of booster upper stages, the Agena vehicle test program is described. The different phases of testing booster upper stages are discussed separately: piece parts and components testing, hazardous and ordnance tests, systems testing, environmental testing, acceptance testing, and prelaunch and checkout. A considerable part of the presentation is devoted to describing the test facilities which contributed to high reliability and to concurrent and steady reduction in Agena program costs. It is stated that the effectiveness of a vehicle system must be high and its cost in relation to its effectiveness must be low, and that careful planning of a test program, vehicle standardization, and automatic test equipment will contribute significantly to desired program results. J.M.D.

N65-23970# Hughes Aircraft Co., El Segundo, Calif. Communications Satellite Lab.

AN INTERNATIONAL COMMERCIAL COMMUNICATION SATELLITE SYSTEM

Harold A. Rosen Paris, EUROSPACE, [1964] 18 p Presented at the U. S.–European Conf., Rome, 22–24 Jun. 1964

A synopsis on the technical development of Syncom, a spin stabilized synchronous communication satellite, is presented. Data on performance, reliability, external and internal design features, cost, components, and launch configuration are included. S.C.W.

N65-24031# Junkers Flugzeug- und Motorenwerke A. G., Munich (W. Germany).

COMPARED COSTS OF SPACE TRANSPORTERS AND OF BOOSTER ROCKETS

J. Lambrecht [1964] 15 p Presented at Eurospace Conf., Brussels, 23–24 Jan. 1964

This report compares the specific costs of ballistic booster rockets with those of aerodynamic space vehicles considering all production and operational costs. To this end, single- and double-stage vehicles, as well as double-stage booster rockets and various propellant combinations are considered. The influence of reuse capabilities and of the overall payload to be transported by the system in course of time is investigated. Fields where special efforts are needed to lower specific costs are emphasized. Author

N65-24045# Royal Aircraft Establishment, Farnborough (England). Space Dept.

FIRST LAUNCHING OF BLUE STREAK—DESCRIPTIVE INFORMATION, E.L.D.O. INITIAL PROGRAMME

[1964] 19 p

The first stage of the Blue Streak rocket and directly associated systems and equipment are described in detail. Also, the flight program and preparation for firing are included. The vehicle has an overall length of 69 ft 3 in.; diameter at the tank bay of 10 ft; takeoff mass, 94 tons; total thrust 274 000 pounds at takeoff and 340 000 at cutoff; total propellant flow 1120 lb/sec at takeoff and 1185 lb/sec at cutoff. Under takeoff conditions, the turbopump in each engine burns 10.8 lb of propellant/sec in the gas generator, causing the turbine to deliver 2600 hp to the propellant pumps. The turbine speed is about 29 800 rpm. Inside the thrust chambers, hot gases are formed by the combustion of kerosene and liquid oxygen. The initial temperature of the gases exceeds 5000° F. E.E.B.

N65-24047# Societe Anonyme Belge de Constructions Aeronautiques, Brussels (Belgium).
AEROSPACE CARRIER. MISSIONS AND SPECIFICATIONS [TRANSPORTEUR AEROSPATIAL. MISSIONS ET SPECIFICATIONS]
25 Oct. 1963 6 p refs In FRENCH
(RP-63-510-25)

Possible applications of a conceptualized launch vehicle, the Aerospace Carrier, are discussed. The Aerospace Carrier will be able to place into orbit the specialized equipment necessary for establishing and maintaining manned orbiting space stations. It can serve quite generally for launching equipment for revitalizing satellites, thus shortening the gap between active and orbital life. Also, it will facilitate lunar and planetary missions to be conducted from orbiting space stations. It is expected that the Aerospace Carrier can be developed within 10 years. Based on optimization studies, launch vehicle propulsion systems which utilize atmospheric oxygen for one or more stages are recommended; use of such compact systems can lead to reduced vehicle size, make possible the more complex designs required for recoverable vehicles, and result in lower program costs. J.M.D.

N65-24098# National Research Council of Canada, Ottawa. Radio and Electrical Engineering Div.
OPERATIONS REQUIREMENT FOR BLACK BRANT ROCKET AD-II-36
A. Staniforth 15 Feb. 1964 70 p
(ERB-665)

Discussed are the operations requirements for the Black Brant IIA vehicle, designed to take measurements in the upper atmosphere during aurora, darkness with no cloud cover and no moon, absence of exceptional solar activity or polar cap absorption events, and during a near pass of the Alouette satellite. Test objectives are (1) measurement of electron density structure within an aurora by a radiofrequency probe; (2) measurement of electrical field potential profiles; (3) X-ray detection for correlation with neutron detection data; (4) Langmuir probe measurements of electron density and electron detection; and (6) neutron detection. Secondary experiments constitute S-band receiver data from the 228.0 range, and photometer observations within an auroral formation. G.G.

N65-24099# National Research Council of Canada, Ottawa. Radio and Electrical Engineering Div.
OPERATIONS REQUIREMENT FOR BLACK BRANT ROCKET AK-II-59
F. V. Cairns Jun. 1964 91 p
(ERB-678)

Range requirements in support of Black Brant AK-II-59 rocket firing are detailed. Since the desired experimental conditions include aurora, darkness, no cloud cover, and no exceptional solar activity of polar cap absorption event, holds may be requested at either or both T-3.5 min and T-1.5 min. The experiments include falling probe electron density, electric field probe, X-ray, ionospheric inhomogeneities, Langmuir probe, micrometeorite, and neutron detector. General information on operations command, range time utilization, test vehicle description, users instrumentation, and frequency utilization is given. Requirements are specified under data, meteorological services, support instrumentation, material and services, transportation logistics, recovery, aircraft and seacraft, data processing and disposition, facilities, and range safety. M.P.G.

N65-24336# National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.
BLACK BRANT II NOSE CONE HEATING FOR COLD WEATHER FIRING
L. G. Cox Jan. 1963 9 p
(ERB-625)

The rate of cooling of the instrumentation H-frame in Black Brant II rockets and the heating power necessary to maintain the instrumentation above 20° C are determined. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N65-23366 Joint Publications Research Service, Washington, D. C.
NON-LINEAR STABILITY PROBLEMS OF ROUND BOTTOM THIN SPHERICAL SHELL. III: NON-LINEAR PROBLEMS OF ROUND BOTTOM THIN SPHERICAL SHELL WITH CENTERED HOLE UNDER MOMENT OF FORCE EVENLY DISTRIBUTED AT THE INNER BOUNDARY
Jen-Huai Liu *In its* Transl. on Communist China's Sci. and Technol. 29 Apr. 1965 p 24–29 refs (See N65-23363 13-34) CFSTI: $3.00

The nonlinear stability of the center-holed round bottom thin spherical shell under evenly distributed moment of force at the inner boundary was studied. Trial and error methods were used to solve nonlinear boundary problems of the center, suspended inner boundary, and opposite boundaries. The angle of deflection of the outer boundary of the shell was selected as the substitution parameter. The following conclusions were drawn: (1) the larger or smaller the center hole, the better the stability of the shell, and (2) the center-holed round bottom spherical shell of $\alpha = 0.40$ is the most sensitive shell reflecting loss of stability. At the same time, the geometric parameter k (thickness) of the shell reaches minimum. Assuming that $k = 0$ in the equation $m = (\alpha_1 + \alpha_2 k^2)\beta + \alpha_3 k \beta^2 + \alpha_4 \beta^3$ the dimensional design equation for large bending angles of the circular thin plate, under evenly distributed moment of force at the inner boundary with simply supported outer boundary, was obtained. Reference is made to the application of this method to the nonlinear stability problems of other boundary conditions and under different loads. S.C.W.

N65-23411 Joint Publications Research Service, Washington, D. C.
METHOD OF SUCCESSIVE APPROXIMATIONS IN THE PROBLEM OF IRREGULAR CREEPING
A. A. Il'yushin and I. I. Pospelov *In its* Eng. Journal 26 Apr. 1965 p 89–98 refs (See N65-23402 13-23) CFSTI: $6.00

A method of solving problems of creep theory is presented that is an extension of the method of elastic solutions. The method permits reducing the nonlinear problems of the theory of creeping to linear problems. The successive approximations in the problem of irregular creeping take into consideration basic equations of the theory, static equilibrium expressed in stresses, elastic deformation, and longitudinal bending of a rod. R.C.S.

N65-23412 Joint Publications Research Service, Washington, D. C.
VIBRATIONS OF MULTILAYER CURVILINEAR RODS
V. V. Bolotin *In its* Eng. Journal 26 Apr. 1965 p 99–107 refs (See N65-23402 13-23) CFSTI: $6.00

Equations of small vibrations of curvilinear rods consisting of alternating rigid and soft layers are derived. A simplified variant is provided of equations suitable for the case of a sufficient number of layers. Frequencies of the inherent vibrations of a multilayered round ring are determined. Author

N65-23413 Joint Publications Research Service, Washington, D. C.
METHODS FOR CONSIDERING INTERNAL DISSIPATION OF ENERGY IN VIBRATIONS
Yu. V. Osetinskiy *In its* Eng. Journal 26 Apr. 1965 p 108–117 refs (See N65-23402 13-23) CFSTI: $6.00

Energy internal dissipation effect on the process of mechanical vibrations of a body is considered, and various assumptions are introduced for the type of functional relation between stress and deformation. The two hypotheses used are N.N. Davidenkov's and Ye. S. Sorokin's. In the case of energetic equivalence of various loops of hysteresis, the form of the loop has no effect on the results of solving the problem of free vibrations. Sorokin's hypothesis is shown to have the following advantage over Davidenkov's: in using the method of slowly changing amplitudes, the necessity disappears for splitting up the nonlinear terms of the differential equation of movement in the Fourier series to isolate the first harmonic. A comparison is made of the two hypotheses to further the explanation of the problem, and the reliability of each of them. R.C.S.

N65-23418 Joint Publications Research Service, Washington, D. C.
SOME CONSIDERATIONS ON BENDING OF THICK CIRCULAR PLATES UNDER ARBITRARY LOAD
A. A. Babloyan *In its* Eng. Journal 26 Apr. 1965 p 163–174 refs (See N65-23402 13-23) CFSTI: $6.00

The bending of a thick, circular, isotropic plate under an arbitrary load that is nonsymmetrical with respect to the axis and applied at the base, is examined. The problem is solved by the Fourier method, with the use of the basic equations of the theory of elasticity. The determination of integration constants involves the solution of infinite systems of linear algebraic equations. It is assumed that, for the cylindrical surface of the plate, certain displacement values are known. The infinite systems obtained are quasi-regular in nature and have free terms having an upper limit value. By changing the limit conditions, a number of problems can be solved exactly without using infinite systems. R.C.S.

N65-23420 Joint Publications Research Service, Washington, D. C.
THE EFFECT OF RIGID ELEMENTS ON FREE OSCILLATION FREQUENCIES OF CIRCULAR, CYLINDRICAL SHELLS
A. I. Men'shov *In its* Eng. Journal 26 Apr. 1965 p 184–197 refs (See N65-23402 13-23) CFSTI: $6.00

A closed circular thin-walled cylindrical shell, reinforced by lateral and transversal ribs for greater rigidity, is examined and a system of coordinates is selected to determine the influence of the ribs on the frequency of free oscillations, using energy method stress calculations. The results indicate that rigid transversal ribs reinforcement increases the frequency of all forms of free oscillations in a cylindrical shell when n is greater than 2, that lateral reinforcement worsens the dynamic properties of a shell, and that the solution of the given formula makes it possible to compute the frequency characteristics of reinforced cylindrical shells. R.C.S.

N65-23510 Joint Publications Research Service, Washington, D. C.
THE PENETRATION OF A CURVED PUNCH INTO A PLASTIC STRIP
L. S. Agamirzyan *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 128–145 refs (See N65-23500 13-01) CFSTI: $6.00

The problem of the penetration of a curved punch into a plastic strip relates to the problems in which the stress field can be found only after the determination of the velocity field. The Sokolovskiy study developed a general method for the construction of the stress and velocity fields in such problems. Also given in this study is the solution by numerical methods of the problem for the case of a circular punch. Presented is an analytic solution of the problem based on the use of series of the metacylindrical functions. Author

N65-23511 Joint Publications Research Service, Washington, D. C.
ON THE STRESS STATE NEAR CURVILINEAR REINFORCED OPENINGS IN SHELLS
A. N. Guz' and G. N. Savin *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 146–155 refs (See N65-23500 13-01) CFSTI: $6.00

Proposed is an approximate method for the analysis of the stress state in shells weakened by curved openings whose boundaries do not have sharp corners. However, starting from the general formulation of the problem and the results of the approximate method, the stress state is studied in shells near curved cutouts reinforced with thin elastic rings (considered as material filaments) which resist tension, bending, and torsion. The boundary conditions for this case were obtained from the approximate method. Author

N65-23512 Joint Publications Research Service, Washington, D. C.
ON THE EFFECT OF SHEARS ON THE BEHAVIOUR OF THIN-WALLED TUBES
V. B. Meshcheryakov *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 156–167 refs (See N65-23500 13-01) CFSTI: $6.00

For analysis of thin-walled tubes, equations are derived which take shears into account. The effect of shears on the bending deflections and the angles of twist of the cross sections is studied for a tube with a longitudinal cutout; allowance for shears is relatively simple and provides greater accuracy for short tubes. Various theories, some including and some neglecting shears, are compared in calculation of angles of twist

for a tube with a diaphragm on the end; the theory whose calculated values come closest to experimental values is identified. References are given for the theories discussed in this paper. J.M.D.

N65-23513 Joint Publications Research Service, Washington, D. C.
THE STUDY OF THE STRESS STATE OF A CYLINDRICAL SHELL WOUND FROM GLASS FIBER
A. N. Yelpat'yevskiy and V. V. Vasil'yev *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 168–188 refs (See N65-23500 13-01) CFSTI: $6.00

The purpose of the paper is the evaluation of the role of the edge effect on the stress state and the deformation state of the shell. It is shown that the stress state of the shell considered can be divided into the momentless state and edge-effect state, in the study of which there is approximate account taken of the relative shear of the layers. The problem is solved in terms of stresses with the aid of the principle of least work. For the solution of the obtained equation the method of asymptotic integration in the form developed by Gol'denveyzer is applicable. Author

N65-23514 Joint Publications Research Service, Washington, D. C.
AN INVESTIGATION OF THE EDGE EFFECT IN A CYLINDRICAL FIBERGLASS SHELL
V. V. Vasil'yev *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 189–207 refs (See N65-23500 13-01) CFSTI: $6.00

The axisymmetric deformation of a cylindrical shell consisting of a large number of layers of glass cloth bonded by a polymer resin is considered. The characteristic feature of this construction is the significant difference between its stiffness in tension, which is determined by the glass reinforcement, and the stiffness in shear of layers between themselves, which is determined by the binder. This feature of the shell structure suggests that the lateral shear which is not considered by the classical theory has a considerable effect on the shell's stress state. The problem is the construction of the law of distribution of the tangential stresses across the thickness of the shell in the zone of the edge effect; here the shell is considered so thin that the compressibility of the normal to its midsurface can be neglected. The stress state is broken down into momentless state and the edge effect, which is determined by the conditions of the edge support and the stiffness of the binder layers in shear. Author

N65-23522 Joint Publications Research Service, Washington, D. C.
ON THE COMPARISON OF CERTAIN FREQUENCY EQUATIONS IN THE USE OF THE PLANE SECTION LAW AND EXACT LINEARIZED THEORY
K. K. Livanov *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 256–261 refs (See N65-23500 13-01) CFSTI: $6.00

In the problem of the motion of a rigid strip which is free at one end and elastically clamped at the other in a supersonic gas flow, frequency functions obtained from the law of plane sections and from exact linearized theory are compared. Expressions for the gas pressure on the oscillating strip are presented under both theories. Approximate forms of these equations are derived but not evaluated. From the approximations it appears that at high flow velocities the frequencies for the two cases approach each other. From the approximate equation under the linearized theory, it is concluded that for positive flow velocity the motion of the strip must be stable. J.M.D.

N65-23523 Joint Publications Research Service, Washington, D. C.
ON THE LOAD CARRYING CAPACITY OF A SHALLOW SPHERICAL SHELL
P. Kh. Dergach and V. P. Shevchenko *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 262–267 refs (See N65-23500 13-01) CFSTI: $6.00

Limiting equilibrium is investigated for a shallow spherical shell which is assumed to be simply supported along the contour and subject to a uniformly distributed normal pressure. The support and loading are axisymmetric, and the shell material is considered to be rigid plastic obeying the Tresca plasticity condition and the corresponding flow law. Equations of equilibrium of the shallow spherical shell are stated, which are functions of radial and circumferential bending moments and membrane forces, the shearing force, the load intensity, and the slopes of the shell prior to and after deformation. These differential equations, with the addition of yield and boundary conditions, lead to an integrated expression for the load-carrying capacity of a shallow spherical shell with uniform load over the entire area. J.M.D.

N65-23524 Joint Publications Research Service, Washington, D. C.
FREE TORSIONAL VIBRATIONS OF A CIRCULAR CONE WITH A CERTAIN TYPE OF CYLINDRICAL ANISOTROPY
Yu. P. Gulyayev *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 268–273 refs (See N65-23500 13-01) CFSTI: $6.00

Free torsional vibrations of a circular cone in which the axis of cylindrical anisotropy coincides with the geometric axis, and in which all radial planes have elastic symmetry, is studied theoretically. All points of the contour of the cone base are considered to be rigidly clamped. Differential equations are formulated in which tangential displacement and stress components are expressed in terms of the angle of rotation of an elementary ring of area of the cone cross section, and boundary conditions are stated. Using the Fourier method of separation of variables, expressions are obtained for the natural frequencies of the cone torsional vibrations, which lead to a general solution to the problem in which orthotropic and isotropic cones are special cases. Investigation of the derived equations reveals that for small vertex angles the effect of anisotropy is negligible, but for angles greater than 10 degrees it results in sharp reduction of the frequencies of the natural vibrations. J.M.D.

N65-23542# Joint Publications Research Service, Washington, D. C.
TURBINE BLADE VIBRATION: CRITICAL SPEED OF TURBINE ROTORS
R. S. Deych and V. Ya. Kal'mens 22 Apr. 1965 22 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), no. 4, Apr. 1964
(JPRS-29718; TT-65-30799) CFSTI: $1.00

CONTENTS:

1. VIBRATION OF THE TURBINE BLADES OF TURBOCOMPRESSORS R. S. Deych p 1–10 ref. (See N65-23543 13-32)

2. EFFECT OF THE FIT OF DISKS AND BUSHINGS ON THE BENDING AND THE CRITICAL SPEED OF A TURBINE ROTOR V. Ya. Kal'mens 11–19 refs (See N65-23544 13-32)

N65-23543 Joint Publications Research Service, Washington, D. C.
VIBRATION OF THE TURBINE BLADES OF TURBOCOMPRESSORS

R. S. Deych *In its* Turbine Blade Vibration: Critical Speed of Turbine Rotors 22 Apr. 1965 p 1–10 ref (See N65-23542 13-32) CFSTI: $1.00

The causes of vibrations of the turbine blades of turbocompressors for supercharging diesels were studied. It was found that resonance stresses in the turbine blades increase as the load on the engine and the supercharging pressure increases. Also, it was observed that the aerodynamic qualities of the gas feed channels of the turbine housing and the nozzle box assembly have an essential effect on the magnitude of the disturbing forces causing vibration of the blades. Increase in the clearance between the nozzle box assembly and the turbine wheel leads to a certain reduction in the magnitudes of the disturbing harmonics. A method is proposed which makes it possible to check the efficiency of measures for reducing the amplitudes of the disturbing forces. E.E.B.

N65-23544 Joint Publications Research Service, Washington, D. C.

EFFECT OF THE FIT OF DISKS AND BUSHINGS ON THE BENDING AND THE CRITICAL SPEED OF A TURBINE ROTOR

V. Ya. Kal'mens *In its* Turbine Blade Vibration: Critical Speed of Turbine Rotors 22 Apr. 1965 p 11–19 refs (See N65-23542 13-32) CFSTI: $1.00

The results of an experimental investigation of the stiffening effect of capping bushings on the bending and the critical speeds of a turbine rotor are reported. The tests included the bending of the model of the shaft, with the bushings fitted on it, and comparison of the strains obtained with the strains which the same shaft would have without bushings. The dimensions of the model were equal to 1.20 full scale. Investigations were also conducted in a relatively large rotor with shaft diameter of 110 mm. It was concluded that the stiffening effect of bushings on the bending and critical speed of a turbine rotor is essential and is dependent upon the speed of revolution. Also, since the effect of the packing on the stiffness of the rotor is secondary, the results of tests with simple bushings may be used. E.E.B.

N65-23644# General Electric Co., Philadelphia, Pa. Space Sciences Lab.

ATTENUATION OF SHOCKS PRODUCED BY UNLIKE METAL IMPACT

J. F. Heyda and T. D. Riney Elgin AFB, Fla., Res. and Technol. Div., Apr. 1965 27 p refs
(Contract AF 08(635)-3781)
(ATL-TR-65-26; AD-461267)

An analytical model is presented for determining the peak axial pressure generated at various depths in the target when impacted at hypervelocity by a projectile of similar or dissimilar material. Detailed calculations are given for impact of aluminum, iron, lead, and copper into aluminum targets. Available experimental data for impact into aluminum targets are discussed in terms of the theory. Author

N65-23660*# Aerojet-General Corp., Azusa, Calif. Advanced Programs Dept.

THERMAL STRAIN ANALYSIS OF ADVANCED MANNED SPACECRAFT HEAT SHIELDS Second Quarterly Status Report, 1 Dec. 1963–29 Feb. 1964

W. T. Cox et al Mar. 1964 29 p refs
(Contract NAS9-1986)
(NASA-CR-62661; Q-5654-01-2) CFSTI: HC $2.00/MF $0.50

The derivation of all equations and boundary conditions based on the thick-shell and thin-shell theories in spherical and toroidal coordinates was completed. Also, a reevaluation of the equations near the singularity on the geometric axis of symmetry resulted in a usable set of equations for the singular-point for nonaxisymmetric case. Further, it was established that line-relaxation offered considerable advantages over point relaxation for the present problem. Effort in the programing area was concentrated on the completion of the axisymmetric case. The major problems encountered were in satisfying all the boundary conditions by the first-approximation solution without generating discontinuities at nearby mesh points. The difficulty stems from the fact that the finite-difference formulation using the mesh-size imposed by the problem does not model the continuous derivatives satisfactorily near the boundary when standard finite-difference formulations are used. E.E.B.

N65-23670*# Aerojet-General Corp., Azusa, Calif. Advanced Programs Dept.

THERMAL STRAIN ANALYSIS OF ADVANCED MANNED SPACECRAFT HEAT SHIELDS First Quarterly Status Report, 1 Sep.–30 Nov. 1963

A. Zukerman Dec. 1963 53 p refs
(Contract NAS9-1986)
(NASA-CR-62660; Q-5654-01-1) CFSTI: HC $3.00/MF $0.50

The derivation of the basic equations in the appropriate coordinate systems for the general nonaxisymmetric case was completed. The finite difference analogs to the partial differenca equations were derived for the general case based on the thick shell theory. Further, the equations for the general nonaxisymmetric case possess a singularity on the geometric axis of symmetry. Inasmuch as this singularity is not an essential singularity, it was considered possible to formulate locally valid nonsingular equations for this point. A summary of the effort to derive such a formulation was presented. Since the additional programing required to use this formulation and the complications introduced would probably not justify the possible benefits, it was decided to establish the singularity region by use of the simplified axisymmetric test case. Also, programing of the input data modeling and the equilibrium coefficient evaluation/storage subroutines was about 50% complete for the two media axisymmetric test case. E.E.B.

N65-23684*# National Aeronautics and Space Administration, Washington, D. C.

NOTE ON THE CALCULATION OF RESISTANCE AND FLEXURE OF SOLID STRUCTURAL PARTS WITH SINGLE AND DOUBLE CURVATURE, WITH CONSIDERATION OF THE VARIOUS FORCES ACTING ON THE PARTS IN ALL DIRECTIONS [MEMOIRE SUR LE CALCUL DE LA RESISTANCE ET DE LA FLEXION DES PIECES SOLIDES A SIMPLE OU A DOUBLE COURBURE, EN PRENANT SI MULTANEMENT EN CONSIDERATION LES DIVERS EFFORTS AUXQUELS ELLES PEUVENT ETRE SOUMISES DANS TOUS LES SENS]

Barre de Saint-Venant May 1965 18 p refs Transl. into ENGLISH from Comp. Rend. (Paris), v. 17, 1843 p 942–954
(NASA-TT-F-9351) CFSTI: HC $1.00/MF $0.50

The theories of Navier, covering only the case of stress in single-curvature solid structural members are rectified and extended to double-curvature parts subjected to simultaneous torsion and flexure, including interaction of the individual fibers and cross sections. Equations of equilibrium for external and internal forces, with emphasis on dilation and slip, are given indicating the numerical maximum for the various forces in members with free and clamped end. A general method is developed for determining unknown reactions and interactions in any system of solid bodies, which subdivides

the member into individual elements and thus defines the forces involved by no more than six indeterminates, eliminating the Poisson transcendental discontinuity formulas. Author

N65-23687*# National Aeronautics and Space Administration, Washington, D. C.
CONTROL EFFECTS ON THE ELASTIC BLADE OF A HELICOPTER ROTOR [EFECTUL COMENZII LA PALELE ELASTICE ALE ROTORULUI DE ELICOPTER]
Al. Marinescu May 1965 20 p refs Transl. into ENGLISH from Studii Cercetari de Mecanica Aplicata (Bucharest), v. 14, no. 5, 1963 p 1073–1087
(NASA-TT-F-9371) CFSTI: HC $1.00/MF $0.50

Forced vibrations of the blade of a helicopter rotor are investigated, where the perturbation forces are due to the effect of the control (at a variation with time of the collective setting angle, respectively, of the amplitude of cyclic variation). The effect of the control during abrupt changes, as well as the same effect during gradual oblique changes in command, is considered. It is emphasized that an integration of the equations of motion of the blade is necessary, by means of a Laplace transformation; the conditions required for attenuation or complete disappearance of these vibrations are given. Author

N65-23700# General Motors Corp., Indianapolis, Ind. Allison Div.
ALLISON RESEARCH AND ENGINEERING, VOLUME NO. 5, FIRST QUARTER 1965
[1965] 28 p refs

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1. THE FILAMENT WOUND PRESSURE VESSEL R. L. Stedfeld and C. T. Hoover p 2–15 refs (See N65-23701 13-32)

2. RADIANT ENERGY CONVERSION A. H. Smith and R. C. Bourke p 16–22 (See N65-23702 13-03)

N65-23701 General Motors Corp., Indianapolis, Ind. Allison Div.
THE FILAMENT WOUND PRESSURE VESSEL
R. L. Stedfeld and C. T. Hoover *In its* Allison Res. and Eng., Vol. No. 5, 1st Quarter 1965 [1965] p 2–15 refs (See N65-23700 13-32)

This paper describes the process, materials, and fundamental design procedures for filament-wound pressure vessels and solid-propellant rocket motor cases. Author

N65-23713*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
ANALYSIS OF PRESSURIZED AND AXIALLY LOADED ORTHOTROPIC MULTICELL TANKS
Robert E. Blum Washington, NASA, May 1965 20 p refs (NASA-TN-D-2799) CFSTI: HC $1.00/MF $0.50

Expressions for nondimensional stress resultants and displacements are derived for multicell tanks of orthotropic construction loaded by internal pressure and axial compression, where the net axial load is assumed below the buckling value. The present analysis removes an incompatibility appearing in a previous solution for isotropic tanks. For isotropic tanks the axial stresses obtained from the present analysis differ significantly from previous results; however, all other stresses are in complete agreement. The corrected axial stresses are presented in curves. Author

N65-23753# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEWS OF THE INSTITUTES OF HIGHER LEARNING Selected Articles
10 Apr. 1963 30 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), no. 3, 1962 p 79–86, 177–186
(FTD-TT-63-203/1+2+4; AD-415659)

CONTENTS:

1. THE STABILITY OF A CYLINDRICAL SANDWICH SHELL WITH A CORRUGATED METAL FILLER EXPOSED TO THE JOINT ACTION OF AXIAL FORCE AND EXTERNAL PRESSURE BEYOND THE ELASTIC LIMIT I. A. Yefimov p 1–12 refs (See N65-23754 13-32)

2. A METHOD FOR ECONOMIC ANALYSIS OF THE RELIABILITY OF PARTS AND SYSTEMS OF FLYING VEHICLES I. I. Drakin p 13–27 refs (See N65-23755 13-32)

N65-23754 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STABILITY OF A CYLINDRICAL SANDWICH SHELL WITH A CORRUGATED METAL FILLER EXPOSED TO THE JOINT ACTION OF AXIAL FORCE AND EXTERNAL PRESSURE BEYOND THE ELASTIC LIMIT
I. A. Yefimov *In its* News of the Inst. of Higher Learning 10 Apr. 1963 p 1–12 refs (See N65-23753 13-32)

An examination is made of the local stability of a sandwich circular cylindrical shell with a corrugated metal filler under the joint action of an axial force and a normal external pressure beyond the elastic limit. It is assumed that at the instant stability is lost the bearing layers are in a purely plastic state and the filler is operating in the elastic region. Further, the filler is considered to be continuous orthotropic and its linear strain is neglected. Also, bearing layers with identical mechanical characteristics and thicknesses are considered isotropic. E.E.B.

N65-23755 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD FOR ECONOMIC ANALYSIS OF THE RELIABILITY OF PARTS AND SYSTEMS OF FLYING VEHICLES
I. I. Drakin *In its* News of the Inst. of Higher Learning 10 Apr. 1963 p 13–27 refs (See N65-23753 13-32)

An increase in the reliability of parts and units usually requires an increase in weight and expense. A method for determining a rational relationship between increased reliability vs. the increased weight and cost, is presented. Mathematical expressions are derived which when plotted on a logarithmic scale provide regions in which redundancy of equipment for tactical or transport aircraft is justified in order to increase reliability, and regions in which such duplication is not justified. E.E.B.

N65-23756# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE POSTBUCKLING BEHAVIOR OF UNIFORMLY COMPRESSED WEBS STIFFENED BY A LONGITUDINAL RIB PLACED IN THE WEB AXIS
M. Skaloud and R. Novotny 1 Apr. 1965 41 p refs Transl. into ENGLISH from Acta Tech. (Prague), no. 3, 1964 p 217–249
(FTD-TT-64-1059/1+2; AD-461640)

On the basis of nonlinear theory of large deflections postbuckling behavior of uniformly compressed webs reinforced

by one longitudinal stiffener placed in the web axis was investigated. The web was simply supported so that (1) the longitudinal edges could approach freely, and (2) the longitudinal edges could not approach. The problem was solved by the energy method. For various rigidities of the stiffener, deformation of the web, the deflection of the stiffener and the stress state of the buckled web were determined. The limiting load of stiffened webs and the limit of efficiency of ribs were found. It follows from the conclusions of the study that the ribs designed according to the conception of theoretical optimum rigidity deflected with the web in the postbuckling range, that their limit of efficiency was limited so that the ribs did not act in the majority of the postbuckling range. So that the stiffeners could rest fully effective in this range, their rigidity had to be increased substantially. Author

N65-23766# Aeronautical Research Labs., Melbourne (Australia).
THE STRESS ANALYSIS OF A RADIAL FLOW IMPELLOR
N. S. Swansson Aug. 1963 30 p refs
(ARL/ME-259)

A digital computer program was developed to determine the rotational stresses in a rotor consisting of a disc and radial blades. The analysis covers discs without any radial plane of symmetry, including single-sided unshrouded radial compressor and turbine impellers; the program can readily be applied to any such impeller. Although the method uses some simplifying assumptions, results compare reasonably well with alternative rigorous methods of analysis when available, and are supported by the limited experimental evidence available. Author

N65-23786* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REAL TIME ANALOG COMPUTER SIMULATION OF THE ELASTIC SPACE VEHICLE INVOLVING BEAM CELL TRANSMISSION MATRICES
George L. von Pragenau *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 42–54 refs (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

An electronic model of the Saturn V vehicle was successfully operated together with a control loop to stabilize the vehicle's attitude. The lateral deflection of the beam was displayed by the lateral acceleration at nine stations. Three bending modes or the standing waves resulting from sinusoidal excitation, a traveling wave resulting from unit step excitation, and a reaction of the Saturn V vehicle in the controlled operation mode when excited by a unit step wind force are shown. The frequency response of the model is plotted for sinusoidal excitation at the tail of the vehicle for the frequency range of 0.5 to 10 Hz. A block diagram of the vehicle model and its matrix formulation are included. Author

N65-23787* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONSTRUCTION OF ELASTIC BODY MODELS FROM SATURN DYNAMIC TEST RESULTS
John H. George and Maurice E. Singley *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 55–61 refs (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

A mathematical procedure is presented for obtaining models for dynamic systems. This procedure was used to obtain mathematical models of the elastic body dynamics for Saturn cluster mode vehicles. Theoretical procedures were not available for adequately describing the elastic body dynamics. For this reason, it was necessary to utilize this procedure for obtaining mathematical models directly from test data. Examples were taken from flight vehicle dynamic testing. Author

N65-23789* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIMULATION OF FLEXIBLE BODY DYNAMICS BEHAVIOR
Glen D. Ritter *In its* Astrionics Res. and Develop. 1 Mar. 1965 p 66–71 refs (See N65-23781 13-34) CFSTI: HC $4.00/MF $0.75

A method for computing flexible body natural frequencies, mode shapes and slopes, and generalized mass during the real time simulation of large launch vehicle flight dynamics is discussed. Derivation of the equations and evaluation of the proposed method through comparison of results with existing theoretical data computed by conventional techniques are described. Although the method was derived for the real time simulation application, it could be used in the routine computation of elastic body data. The method is useful because it avoids the inherent cumulative errors and the difficulties of high ordered determinant manipulation of more conventional approaches. Author

N65-23817*# Measurement Analysis Corp., Los Angeles, Calif.
THE DEVELOPMENT OF VIBRATION TEST SPECIFICATIONS FOR SPACECRAFT APPLICATIONS
G. H. Klein and A. G. Piersol Washington, NASA, May 1965 80 p refs
(Contract NAS5-4590)
(NASA-CR-234) CFSTI: HC $3.00/MF $0.75

Specific steps in the development of specifications are outlined, and procedures currently employed to accomplish each step reviewed. Shortcomings of these current procedures are summarized with emphasis on special problems posed by spacecraft applications. Finally, a logical implementation of state-of-the-art procedures to create efficient vibration test specifications for spacecraft is suggested and outlined. Problems associated with the suggested approach are discussed. Author

N65-23823*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COLLAPSE TESTS OF PRESSURIZED MEMBRANE-LIKE CIRCULAR CYLINDERS FOR COMBINED COMPRESSION AND BENDING
Walter J. Leaumont, Jr. May 1965 18 p refs
(NASA-TN-D-2814) CFSTI: HC $1.00/MF $0.50

Experimental collapse loads are presented for combined compression and bending of internally pressurized membrane-like cylinders with a length–radius ratio of three and with large values of radius–thickness ratio. The results show a linear relationship of compressive loads and bending moments for collapse of cylinders of length such that column-bending effects are negligible. Author

N65-23824*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF EDGE LOADINGS ON THE VIBRATION OF RECTANGULAR PLATES WITH VARIOUS BOUNDARY CONDITIONS
George E. Weeks and John L. Shideler May 1965 37 p refs
(NASA-TN-D-2815) CFSTI: HC $2.00/MF $0.50

The natural vibration characteristics of flat orthotropic rectangular plates with inplane loads and various boundary conditions are investigated theoretically. A set of frequency equations derived is valid for plates having edges simply supported, clamped, or elastically restrained against rotation. The solutions to these frequency equations are presented in terms of two general parameters which are functions of length–width ratio, stiffness ratios, frequency, and inplane stress. These solutions are exact if one pair of opposite edges is simply supported, otherwise the solutions are approximate. However, these approximate solutions are shown to be in excellent agreement with converged modal solutions. The results of the analysis are tabulated so that, for the boundary conditions considered, the buckling stress, and the variation of frequency and modal behavior with inplane stress can be quickly and accurately determined for large ranges of length–width ratio, stiffness ratio, and inplane stress. Author

N65-23830*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME DESIGN CONSIDERATIONS FOR SPIN-STABILIZED SATELLITES WITH RIGID EXPANDABLE STRUCTURES
Robert H. Johns, Reeves P. Cochran, and David A. Spera Washington, NASA, May 1965 40 p refs
(NASA-TM-X-1061) CFSTI: HC $2.00/MF $0.50

To explore the problems of stowage and deployment of expandable structures with rigid plane surfaces, a sample spacecraft mission of a micrometeoroid penetration survey was considered. Variations in the spin-axis attitude of a spin-stabilized spacecraft in several 400-mile circular orbits of the earth also were determined. Of the two types of expandable structures—wrap-around wings and folding umbrellas—the folding umbrella was considered the better choice. Attitude studies that considered only the effects of gravity gradient torque and earth oblateness on the precession of the spin axis of the umbrella package were made for orbits in several planes. A polar orbit with the spin axis either parallel or perpendicular to the orbital plane resulted in an essentially stable attitude of the package. An equatorial orbit with the spin axis parallel to the orbital plane resulted in a relatively stable attitude that could approximate the direction of the earth's orbital velocity vector. The rate of spin affected the rate of axis precession in all orbits but did not affect the magnitude of deviation from the initial orientation for polar and equatorial orbits. Author

N65-23954# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
PRELIMINARY NOTE ON THE RESULTS OF THE WIND-TUNNEL TESTS ON GROUND-WIND LOADS ON THE ELDO-SLV
[1964] 30 p
(FF-14)

Results are given of the wind tunnel tests concerning the determination of the wind-induced loads on the ELDO Satellite launching vehicle. Graphs are presented for both static and dynamic loads on the vehicle. Author

N65-23957# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
PRELIMINARY NOTE ON THE DETERMINATION OF THE BUFFET LOADS ON THE ELDO SLV
[1964] 14 p
(FF-17)

Wind-tunnel tests of an ELDO satellite launching vehicle model were carried out at the 40° and 60° nose cone position, and the buffet loads were measured by strain gage bridges on the balance. Formulas were derived for the dynamic forces and moments in the vertical plane of symmetry with consideration of the Reynolds number and free-stream Mach number. The aerodynamic coefficients did not vary much through the Mach number range. Buffet pressures almost vanished at Mach numbers $\sim M > 0.92$. It was concluded that actual loading induced by the buffet phenomenon may be smaller than the loading corresponding to the aerodynamic coefficients. G.G.

N65-23961# Boeing Co., Seattle, Wash. Aero-Space Div.
STRUCTURES PROBLEMS OF SPACE SYSTEMS
M. B. Dunn [1964] 27 p Presented at Eurospace Conf., Brussels, 23–24 Jan. 1964

The nature and origin of structures problems of space are delineated. The system operational phases considered are the launch, space mission, and reentry phases. Some particular problem areas are selected for more detailed examination. Included are the significance of size in structures assurance and structures allowables, the meteoroid protection problem, lunar landings, and atmospheric reentry heating. Author

N65-24006# Martin Co., Denver, Colo. Aerospace Div.
DYNAMIC ANALYSIS OF LONGITUDINAL OSCILLATIONS OF SM-68B STAGE I (POGO)
F. E. Bikle and J. B. Rohrs Mar. 1964 243 p refs
(Contract AF 04(647)-576)
(CR-64-71; AD-461795)

This linear model is capable of predicting stability of the physical system responsible for the Titan II longitudinal oscillation. The utility of the model extends to development of various stabilizing fixes installed on the fuel and oxidizer suction systems. The model leads to a stability criteria stated in terms of system parameters. This model simulated three longitudinal oscillation characteristics and successfully predicted the onset of oscillations, the convergence of oscillations, and the magnitude of closed-loop measurement ratios. Since the model is linear, it cannot predict acceleration amplitudes. Author

N65-24034*# Allied Research Associates, Inc., Concord, Mass.
DEVELOPMENT AND APPLICATION OF BASIC ANALYTICAL PRINCIPLES FOR MATERIALS AND DESIGN SYNTHESIS TO ADVANCED CONCEPTS FOR SPACE AND LAUNCH VEHICLES Quarterly Progress Report, Mar. 23–Jun. 23, 1964
Roger Milligan 19 Jun. 1964 47 p refs
(Contract NASw-928)
(NASA-CR-56698) CFSTI: HC $2.00/MF $0.50

Two concepts are proposed for utilizing solid structural materials as efficient energy absorbers. It is suggested that the maximum deceleration of a landing vehicle can be controlled by utilizing a landing system design wherein a structural element in the form of a cylindrical shell is designed to deform via the axisymmetric buckling mode. The rate of change of deceleration of the vehicle would be limited by a second structural element in the form of a tapered shell designed to deform plastically at the operating stress. It is postulated that these two basic energy absorbing elements, the deceleration limiter and onset rate limiter, when incorporated in a landing system design would provide vehicle deceleration characteristics similar to those of an ideal energy absorber. Analytical techniques are developed such that a detailed design configuration for these energy absorbing elements can be determined based on gross vehicle and landing system design parameters. Test results are presented for axisymmetric buckled tubes which support the design hypothesis. Author

N65-24053# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics
DEEP OVAL RING EQUATIONS WITH SIMPLIFICATIONS FOR APPLICATION TO RING-SHELL COMBINATIONS
William P. Vafakos Feb. 1964 59 p refs
(Contract Nonr-839(14))
(PIBAL-678; AD-429853)

Equations applicable to deep oval rings in which the local curvature of an arbitrary reference line is prescribed are derived and simplified for application to oval ring-shell combinations. Theoretical estimates of the stresses and displacements are obtained for a typical reinforcing ring of a ring-stiffened oval cylinder recently tested under hydrostatic pressure. These results are obtained by appropriately approximating the oval cross section and by assuming that the composite structure responds as an oval ring. The theoretical flange stresses are shown in good agreement with available test results. Author

N65-24110# Royal Aircraft Establishment, Farnborough (England).
PROGRAMME LOADING FATIGUE TESTS ON A BOLTED JOINT
H. Yeomans London, Min. of Aviation, Mar. 1963 22 p refs
(RAE-TN-STRUCT-327)

Constant amplitude and program loading tests were made on a number of multibolt joint specimens, the joints being assembled with grease and dry. The loading program was based on the gust load spectrum of a short haul transport aircraft. Endurances achieved were compared with endurances predicted from the constant amplitude tests using Miner's cumulative damage hypothesis. Effect of different sequences of loading within the program was investigated. For the constant amplitude tests endurances of the dry and the greased joints were found the same. In the program loading tests the average endurance of the dry joints was 2.5 times that predicted, whereas for the greased joints it was 8.4 times that predicted. Variation of loading sequence in the program loading tests had little effect on endurance of the test specimen. Author

N65-24111# Royal Aircraft Establishment, Farnborough (England).
THE COMBINATION OF STATISTICAL DISTRIBUTIONS OF RANDOM LOADS
N. I. Bullen London, Min. of Aviation, Mar. 1963 26 p refs
(RAE-TN-STRUCT-326)

The case of a random Gaussian process for which the root-mean-square value is itself variable is considered. A distribution for the root-mean-square value is assumed and an expression derived for the resulting distribution of peak values of the variable quantity. This expression is shown to give good agreement with experimental results in many cases of aircraft gust load statistics; its limitations are discussed. Author

N65-24114*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
USE OF DYNAMIC MODELS IN LAUNCH-VEHICLE DEVELOPMENT
H. L. Runyan, H. G. Morgan, and J. S. Mixson [1964] 37 p refs Presented at 18th Meeting of AGARD Struct. and Mater. Panel, Liege, 28 May 1964
(NASA-TM-X-51680) CFSTI: HC $2.00/MF $0.50

The role of reduced scale models in the solution of the structural dynamic problems of large launch vehicles is presented. A general discussion of scaling principles is given, followed by tabulation of the specific parameters for scaling of bending, longitudinal, and local vibrations; liquid sloshing; combined elastic-aerodynamic buffet; flutter; and ground-wind phenomenon. Three examples of the use of models are presented, illustrating the utility of reduced scale models. Author

N65-24128* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WALL PRESSURE FLUCTUATIONS AND SKIN VIBRATIONS WITH EMPHASIS ON FREE SHEAR LAYERS AND OSCILLATING SHOCKS
Fritz R. Krause *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 18-32 refs (See N65-24125 13-34)
CFSTI: HC $4.00/MF $1.00

A new relation between pressure and force correlations has been established for inhomogeneous turbulence to account for the largest pressure fluctuations below oscillating separation and reattachment lines. It shows that the power spectra of the generalized forces can be found from rigid model tests by a curve fit of a special pressure cross correlation function. However, a curve fit of experimental pressure correlations is useful only as long as the statistical error of a cross correlation estimate is smaller than the numerical error of the curve fitting procedure. Nonlinear transfer functions and dynamic shifts in presently available pressure transducers and tape recorders are so large that the more refined force estimates, which consider the spatial structure of the pressure field, might lead to ambiguous results. Author

N65-24130* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ON THE PRESSURE REQUIREMENTS FOR STRUCTURAL RESPONSE EQUATIONS
Richard D. Rechtien *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 44-52 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

The fluctuating pressure requirements for the calculation of flight vibration environments are reviewed in light of the development of a lumped impedance approach to the response problem. This approach demonstrates that the only fluctuating pressure information required is the pressure cross-power spectral densities. For homogeneous anisotropic flow conditions, a considerable simplification in the response equations result. For this flow condition it is suggested that the pressure cross-power spectral density information be reduced to a more elementary form. Author

N65-24131* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A SIMPLE METHOD FOR DETERMINING THE BENDING MOMENT EQUATION THAT INCLUDES VEHICLE ELASTIC AND SLOSHING MODES AND A NUMERICAL EXAMPLE
Robert S. Ryan, Fred Swift, and Don Townsend *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 63-68 (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

The equation is presented in a form easier to use for control optimization techniques, particularly if the bending moment at some critical station is chosen as the value to be optimized. The form of the equation lends itself to any technique used in vehicle dynamic response studies. Also, in this form, the effect of various parameters is completely separated allowing a better survey of causes and effects. A numerical example is given and the effects of angle of attack, engine deflection, bending dynamics, and propellant oscillations are determined. The trade-off between angle of attack and engine deflection is shown graphically. Author

N65-24132* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ON TRANSIENT RESPONSE OF A MULTISTAGE SPACE VEHICLE
Frank C. Liu *In Its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 69–73 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

An analytical solution is presented for the transient response of a multistage space vehicle to a general external load. The structure of the vehicle is considered to be a stepped beam with uniform sections. William-type modal solution for a uniform beam is assumed for each section of it. Upon imposing the conditions of continuity of these sectional continuous functions, these functions should yield equal magnitudes of deflection, slope, bending moment and shear force at the junctions; and the boundary conditions at two ends, the characteristic determinant of natural vibration, and the arbitrary constants of the solutions are determined. The differential equations of the generalized coordinates are obtained by making use of the orthogonality relation of the eigenfunctions. Author

N65-24133* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NONLINEAR VIBRATION OF BEAMS
Frank C. Liu *In Its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 74–79 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

This paper deals with vibration of uniform beams with large amplitude. Two sets of system of nonlinear partial differential equations of two variables are derived for vibratory motions of a beam. One set treats beams with axially fixed ends; the other, beams free of axial constraints. The linear parts of the beam equation in both cases are the Timoshenko type, while the nonlinear terms are triple products of the first and second derivatives of the displacement variables. For practical purposes, the nonlinear terms may be regarded as small quantities; thus, an approximate solution in the form of a power series based on Krylov–Bogoliunov's principle uses the linear solution as a generating function. A simple supported beam and a free-free beam, presented with numerical examples show the variation of the undamped frequency with respect to amplitude of vibration. Author

N65-24134* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LUNAR TOUCHDOWN DYNAMICS STUDIES
Robert E. Lavender *In its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 80–86 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

Results are presented from five brief investigations concerning lunar touchdown dynamics. These investigations concern the use of a rocket motor to achieve a stable touchdown, effect of elasticity on touchdown stability, comparison of different analytical results, landing dynamics for a cryogenic landing stage, and comparison of different results of scale model drop tests. Author

N65-24137* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A METEOROID FLUX AND PUNCTURE MODEL FOR NEAR-EARTH AND CISLUNAR SPACE
Charles C. Dalton *In Its* Aero-Astrodyn. Res. and Develop. Res. Rev. No. 1 1 Oct. 1964 p 96–99 refs (See N65-24125 13-34) CFSTI: HC $4.00/MF $1.00

The model presented for the mean cumulative flux of meteoroids includes the appropriate earth-shielding factor as a function of distance from the surface of the earth and is as accurate as present information will support. A puncture model is presented for vehicles with homogeneous metallic walls. The results can be used to determine the no-puncture probability for particular vehicles and missions when the relation between bumper or sandwich-type wall structures and the equivalent thickness of a homogeneous metallic wall has been established. Author

N65-24264# Italy. Ministero Difesa Aeronautica, Rome. Centro Consultivo Studi e Ricerche
THE AEROTHERMOELASTIC STABILITY OF MEMBRANE-PLATE UNDER PRESSURE [SULLA STABILITA' AEROTERMOELASTICA DI UNA LASTRA-PIASTRA SOTTOPOSTA A PRESSIONE]
Giuliano Quozzo Dec. 1963 45 p refs In ITALIAN; ENGLISH summary *Its* Nuova Ser., No. 7

This work deals with flutter stability of a plate whose constraints are such as to prevent any displacement of the edges, under known temperature distribution and under a load distributed on its surface. Expressions for the displacements of the plate mean plane are determined; aerodynamic action is not taken into account. The limit value of the flutter stability is determined by a linearization procedure of differential equations system and by the results previously obtained. Author

N65-24293*# Space Technology Labs., Inc., Redondo Beach, Calif. Physical Electronics Lab.
STUDY OF MICROMETEOROID DAMAGE TO THERMAL CONTROL MATERIALS Final Technical Report, 7 Feb.–3 Nov. 1964
J. F. Friichtenicht 4 Feb. 1965 60 p refs
(Contract NAS8-11149)
(NASA-CR-62810; STL-4146-6009-SU-000) CFSTI: HC $3.00/MF $0.50

The effect of micrometeoroid bombardment on the thermal radiative properties of metallic thermal control coating surfaces is being studied in a simulated environment. This experimental program consists of measuring the emissivity of highly reflecting metallic materials before and after simulated micrometeoroid exposure. The changes observed are correlated to surface damage in terms of the fractional area covered by craters and the total number of impacting particles. The data indicate that the magnitude of the anticipated change in the actual space environment can be determined providing the meteoroid flux is known, and that the relatively susceptibility to change of various materials can be deduced. The end results depend upon the numbers and properties of the natural meteoroid environment. R.C.S.

N65-24302*# Little (Arthur D.) Inc., Cambridge, Mass.
THERMAL PROTECTION SYSTEMS FOR LIQUID HYDROGEN TANKS
Peter E. Glaser Nov. 1962 64 p refs
(Contract NAS5-664)
(NASA-CR-62859; C-65008-3) CFSTI: HC $3.00/MF $0.75

The importance of the development of thermal protection systems for cryogenic fuels such as liquid hydrogen, for meeting the demands of a wide spectrum of space missions, is discussed. Data are included on (1) the requirements of thermal protection systems subjected to ground and space enviroments; (2) typical materials either presently available or under development; (3) the influence of the physical variables governing the thermal properties of those materials and the apparatus

required for their measurement; (4) possible improvements in thermal protection systems; and (5) design considerations for thermal protection systems, dictated by production, handling, and test requirements. S.C.W.

N65-24371*# National Aeronautics and Space Administration, Washington, D. C.
THE PROBLEM OF DETERMINING THE EXCITATION FORCES IN VIBRATION TESTING [LE PROBLEME DE L'APPROPRIATION DES FORCES D'EXCITATION DANS L'ESSAI DE VIBRATION]
G. de Vries May 1965 19 p refs Transl. into ENGLISH from Rech. Aerospatiale (France), no. 102, 1964 p 43–49 (NASA-TT-F-348) CFSTI: HC $1.00/MF $0.50

Determining the excitation forces is at the same time the most important and the most difficult problem in vibration testing. The reasons the known theories in this field have not led to practical testing methods are discussed. The real behavior of a structure is compared with the theoretical hypotheses, and the differences observed explain why the known methods are not always applicable. Following the demonstration that the appropriation, even when possible, does not provide real advantages for measurement, it is suggested that the problem be reversed by establishing the structure determination by modifying the damping forces distribution for the separation of the modes. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N65-23405 Joint Publications Research Service, Washington, D. C.
THERMODYNAMIC FUNCTIONS OF A GAS MIXTURE AT HIGH TEMPERATURES
R. M. Sevast'yanov and M. D. Zdunkevich *In its* Eng. Journal 26 Apr. 1965 p 28–38 refs (See N65-23402 13-23) CFSTI: $6.00

Accurate analytical expressions for the thermodynamic, transport, and physical properties of a random mixture of nitrogen, oxygen, and argon are derived, taking into consideration unharmonicity of molecular vibrations, electronic excitation of particles, reactions involved in the formation of nitric oxide, and equilibrium dissociation and ionization. In deriving expressions for specific heat, adiabatic flow of the mixture is calculated from the known gas law having a constant equal to the value of the frozen mixture composition. The comparison of computer calculations using these expressions with available data indicates that the error in calculation of the thermodynamic functions for pure gases does not exceed 0.5% and for air, 0.1%. The error of transport properties does not exceed 5% to 10% for pure gases and 10% to 20% for air. R.C.S.

N65-23406 Joint Publications Research Service, Washington, D. C.
VISCOUS HEAT-CONDUCTING GAS FLOW IN A HYPERSONIC SHOCK WAVE
Ye. M. Shakhov *In its* Eng. Journal 26 Apr. 1965 p 39–44 refs (See N65-23402 13-23) CFSTI: $6.00

This report analyzes the effect of the Prandtl number and especially of the viscosity on the structure of the shock wave. It is shown that the asymptotic behavior in the neighborhood of the discontinuity surface remains unchanged for any Prandtl number. For the case where Pr = 3/4 and the viscosity obeys the Sutherland law or a power law with index 1/2, the differential equations of the problem are integrated for any oncoming flow parameters. The solution obtained not only makes it possible to determine existence of a limiting solution, but also determines the character of the asymptotic behavior of solutions near the limiting solution. Author

N65-23416 Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF THE AERODYNAMICS OF A DIFFUSION TURBULENT FLAME BRUSH DEVELOPING IN AN ACCOMPANYING HOMOGENEOUS FLOW
Sh. A. Yepshin and L. P. Yarin *In its* Eng. Journal 26 Apr. 1965 p 135–150 refs (See N65-23402 13-23) CFSTI: $6.00

The community of the mechanism of the transfer of an impulse, heat, and matter in turbulent jet streams and a hot flame is confirmed. It was experimentally established that the profiles of an impulse in asymmetrical boundary conditions (the presence in the boundary layer of sources or heat discharges) have a second extreme. It was shown that the profiles of excessive impulse monotonously change over the cross section of a flame and can be described by equations of the nonstationary thermal conductivity type. The expediency of using a calculation scheme of the equivalent problem of the theory of thermal conductivity for the calculation of the aerodynamics of the diffusion turbulent flame brush which develops in a homogeneous accompanying current was shown. Author

N65-23434 Library of Congress, Washington, D. C. Aerospace Technology Div.
INTENSIFICATION OF COMBUSTION PROCESSES
Paul Vantoch *In its* Foreign Sci. Bull., Vol. 1, No. 5 May 1965 p 12–20 refs (See N65-23432 13-34)

Soviet studies related to the development of high-performance rocket and ramjet combustors are reviewed, and the following approaches to intensification of combustion processes are discussed: intensification of homogeneous combustion by specially designed flame holders and ignition sources; intensification of heterogeneous combustion by flash vaporization of the boiling fuel or oxidizer; and intensification of diffusion flames by interaction with transverse air jets. The theoretical concept of combustion in the predetonation regime is also discussed. Several studies dealing with the minimization of the combustion zone length in ramjets, particularly at high altitudes, are reviewed, and a comparatively recent source is cited in which for the first time the development of two fuel additives is claimed which considerably improved burning characteristics at low pressures. Author

N65-23518 Joint Publications Research Service, Washington, D. C.
CALCULATION OF THE THERMODYNAMIC PARAMETERS OF A GAS BEHIND A STRONG SHOCK WAVE IN HELIUM
V. V. Zhurin and O. K. Kostko *In its* Eng. J., Vol. V, No. 1, 1965 30 Apr. 1965 p 229–235 refs (See N65-23500 13-01) CFSTI: $6.00

A mathematical study was made of the temperatures behind the front of a strong shock wave in helium (velocities

from 1.8 × 10^6 to 9.0 × 10^6 cm/sec), and the ratio of the pressures and the densities for three values of the initial pressure (0.1, 1, and 10 mm Hg). In this range of velocities, the maximum contribution to change in thermodynamic properties of helium is attributed to the effects of ionization. Equations of conservation of mass, momentum, energy, effective masses, and state, are given in terms of the degrees of single and double ionization. An approximate method of computation, which does not introduce appreciable errors, is used in getting numerical solutions to the equations. Results of the computations are presented graphically. Reduction of gas density with increase in shock wave velocity is noted, which is explained by the increase in degree of ionization. J.M.D.

N65-23668*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Operations
ANALYTICAL STUDY TO EXTEND THE CAPABILITIES OF THE AEROJET-GENERAL ABLATION DIGITAL COMPUTER PROGRAM Final Report
D. K. Carlson et al Nov. 1964 154 p refs *Its* Rept.-9410-64-1R
(Contract NAS9-2832)
(NASA-CR-65007) CFSTI: HC $5.00/MF $1.00

A study was conducted to extend the capabilities of the computer program (number 8039). The 8039 computer program calculates temperature distribution, char depth, and dimensional ablation of ablative chambers for large rocket engines. The program operates on a forward finite difference, one dimensional solution to the thermal diffusion equation. The purpose was to modify the computer program to permit performance of ablative heat transfer calculations in cylindrical coordinates with an increased number and variety of boundary conditions. The modified computer program mathematical theory, definition of the mathematical model for programing, operational procedures, and correlation of analyses with experimental data are presented. The new computer program is written in Fortran IV and is acceptable to the IBM 7094 digital computer. Author

N65-23671*# Pratt and Whitney Aircraft, East Hartford, Conn.
COMPUTER PROGRAM FOR LIQUID METAL CONDENSING HEAT TRANSFER COEFFICIENTS INSIDE TUBES Manual
Harold L. Ornstein Mar. 1965 54 p ref
(Contract NAS3-2335)
(NASA-CR-54350; PWA-2556) CFSTI: HC $3.00/MF $0.50

A theoretical analysis that can be used to determine the liquid film thickness and condensing-heat-transfer coefficient at an axial location inside a tube where condensing is occurring is presented. The method also enables determination of the liquid-layer shear-stress distribution, liquid velocity profile, eddy diffusivity for momentum, ratio of eddy diffusivities, and liquid temperature profile. The analysis assumes annular two-phase flow inside circular tubes with no liquid entrainment in the gas core. The final equations derived in that report were programed in Fortran II for the IBM 7094 digital computer. This manual presents the following items of that computer program in detail: (1) program logic, (2) input format and operational instructions, (3) printout format, (4) listing of program statements, and (5) program flow diagram. Author

N65-23681*# National Aeronautics and Space Administration, Washington, D. C.
THERMODYNAMIC FUNCTIONS OF GAS MIXTURES AT HIGH TEMPERATURES [TERMODINAMICHESKIYE FUNKTSII SMESI GAZOV PRI VYSOKIKH TEMPERATURAKH]
R. M. Sevast'yanov and M. D. Zdunkevich Apr. 1965 14 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 4, no. 4, 1964 p 639–645
(NASA-TT-F-9348) CFSTI: HC $1.00/MF $0.50

Needs for simple, accurate analytical expressions of gas properties at high temperatures and uses are cited. The problem of pure and mixed gases and other specific drawbacks in referenced works are discussed. Expressions used by Zdunkevich in his computer work and accuracy of the 50-card program are presented. Author

N65-23715*# National Aeronautics and Space Administration, Washington, D. C.
DETERMINATION OF CERTAIN THERMODYNAMIC PARAMETERS OF SUBSTANCES BY THE SIMILARITY PRINCIPLE [OPREDELENIYE NEKOTORYKH TERMODINAMICHESKIKH PARAMETROV VESHCHESTV S POMOSHCH'YU METODA PODOBIYA]
B. M. Pankratov May 1965 9 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (USSR), no. 4, 1964 p 106–110
(NASA-TT-F-9364) CFSTI: HC $1.00/MF $0.50

The parameters and enthalpy–entropy state diagram are calculated for lithium in the vapor state, applying thermodynamic similarity methods. The criteria for choosing substances thermodynamically similar to lithium are discussed. Scaling factors are calculated so that the data for better known but thermodynamically dissimilar substances in the region of low temperatures and pressures can be extrapolated into the region of high temperatures and pressures for the lithium group. The method is of interest for its applicability in general. Author

N65-23719# Brookhaven National Lab., Upton, N. Y.
HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW, VOLUME 3, NO. 1 Bimonthly Technical Progress Review
Feb. 1965 58 p
(BNL-920 PR-13, Vol. 3, No. 1) CFSTI: $3.00

Abstracts of articles on high-temperature liquid-metal technology progress are reviewed on the subjects of physical properties and thermodynamics, fluid dynamics, heat transfer, material development and corrosion, instrumentation, component development, systems studies, and chemical analysis and chemistry. E.E.B.

N65-23738*# Little (Arthur D.), Inc., Cambridge, Mass.
BASIC INVESTIGATION OF MULTI-LAYER INSULATION SYSTEMS Final Report
Igor A. Black et al 30 Oct. 1964 298 p refs
(Contract NAS3-4181)
(NASA-CR-54191; ADL-65958-00-04) CFSTI: HC $6.00/MF $1.50

Work carried out on the experimental measurements of thermal protection systems for liquid hydrogen tanks is summarized. The purpose of the experimental program was to increase knowledge of the thermal behavior of multilayer insulations and to obtain data on the effects of variables on their performance. Major emphasis was placed on problems of installation and techniques from ground-hold to space conditions. Less emphasis was placed on the theoretical aspects of the behavior of insulation systems. Also, tests to determine the heat leak through various insulation materials installed on calorimeter tanks; and the design, construction, and operation of an emissometer to determine the total hemispheric emittance of materials for multilayer insulations are covered. E.E.B.

N65-23759# Los Alamos Scientific Lab., N. Mex.
RATH THERMAL ANALYSIS PROGRAMS
R. F. Thomas, Jr. and M. D. J. Mac Roberts 5 May 1965 47 p refs
(Contract W-7405-ENG-36)
(LA-3264-MS) CFSTI: $2.00

This report describes four computer codes for the computation of temperatures in solids of general geometry and the display of results. The codes permit temperature-dependent material properties; anisotropic conductivities; and convection, radiation, contact, and specified-flux boundary conditions. Author

N65-23772 International Union of Pure and Applied Chemistry, Basle (Switzerland). Commission on High Temperatures and Refractories
BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF GASES AND GAS-CONDENSED PHASE REACTIONS
L. Brewer, comp. (Calif. Univ.) 31 Mar. 1965 24 p refs

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1. REACTION BETWEEN GASES AND CONDENSED PHASES p 1–18 refs
2. SPECTROSCOPY OF INTEREST TO HIGH TEMPERATURE CHEMISTRY p 19–22 refs

N65-23794*# National Aeronautics and Space Administration, Washington, D. C.
ANALYSIS OF OPTICAL-PYROMETRICAL TEMPERATURE MEASUREMENTS [AUSWERTUNG OPTISCH-PYROMETRISCHER TEMPERATUREMESSUNGEN]
J. Verch May 1965 17 p refs Transl. into ENGLISH from Optik (Stuttgart), v. 19, no. 12, 1962 p 640–651
(NASA-TT-F-9359) CFSTI: HC $1.00/MF $0.50

A numerical procedure permitting analysis of temperature measurements by optical pyrometry is described. The determination of the effective wavelength normally carried out with present methods and the entailed iterative procedure are eliminated. A high degree of accuracy is attained with a limited amount of calculation: for three typical commercial color filters, the maximum errors arising from the calculations are between 0.01° and 0.04° for a temperature range of 1200° to 3000° K. Author

N65-23816*# Hughes Research Labs., Malibu, Calif.
TEMPERATURE DISTRIBUTION IN A SPINNING SPHERICAL SHELL IN THE SOLAR FLUX. UNIFORMLY VALID PERTURBATION EXPANSION FOR A THIN SHELL
W. P. Brown, Jr. Washington, NASA, May 1965 60 p refs
(Contract NASw-1056)
(NASA-CR-233) CFSTI: HC $3.00/MF $0.50

A method for calculating a uniformly valid perturbation expansion of the temperature distribution in a thin spherical shell is discussed. Results revealed that the conventional perturbation approach yields a valid zero order approximation although it provides no means of estimating the error incurred in the approximation. Information concerning the error and the form of the correction terms can be obtained only if singular perturbation techniques are employed. The perturbation method was illustrated by the derivation of the first few terms in the uniformly valid perturbation expansions of the temperature distribution in spinning shells for the cases of slow and rapid rotation. The analysis showed that the zero order temperature distribution in slow rotation is identical with that in a stationary shell. Also, the zero order temperature distribution for the rapid rotation is identical to the case of an infinite rate of rotation. Further, in the case of slow rotation, the temperature distribution is centered about an axis defined by the direction of the solar flux vector. In other cases, the temperature distribution generally consists of a hot zone near the upper pole defined by two axes of rotation, a zone of intermediate temperature in the vicinity of the equator, and a relatively cool zone near the lower pole. E.E.B.

N65-23825*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ONSET OF FLOW OSCILLATIONS IN FORCED-FLOW SUBCOOLED BOILING
Frank A. Jeglic and Thomas A. Grace Washington, NASA, May 1965 37 p refs
(NASA-TN-D-2821) CFSTI: HC $2.00/MF $0.50

A study was made of the onset of flow oscillations occurring when a subcooled liquid undergoes a phase change under forced-flow conditions in a single-tube boiler. Experimental data were obtained with electrically heated tubes of variable length over a range of fluid velocities, temperatures, and pressures. The experiments were conducted at system pressures of 3 to 100 psia with degassed, demineralized water flowing vertically upward through the heated test tube. Visual studies were made in which boiling was simulated by injecting steam or air through the porous wall of a tube. A mathematical model predicting the necessary criterion for the onset of oscillations was formulated on the basis of local rates of bubble growth and collapse. Good agreement was obtained between the experimental and theoretical results. Author

N65-23838# Library of Congress, Washington, D. C. Aerospace Technology Div.
COMBUSTION INSTABILITY IN LIQUID-ROCKET AND AIR-BREATHING PROPULSION SYSTEMS
Paul Vantoch *In its* Foreign Sci. Bull. Apr. 1965 p 14–23 refs (See N65-23836 13-34) CFSTI: HC $3.00/MF $0.75

Soviet research on compression wave–flame front interaction, theoretical derivation of stability criteria, and experiments on combustion instability are reported. Factors influencing combustion stability are summarized and discussed together with measures suggested for suppressing instability. Author

N65-23839 Library of Congress, Washington, D. C. Aerospace Technology Div.
RECENT SOVIET EXPERIMENTAL STUDIES ON GAS DYNAMICS AND PROPERTIES OF GASES AT HIGH TEMPERATURES
Alexis Baratoff *In its* Foreign Sci. Bull. Apr. 1965 p 24–28 refs (See N65-23836 13-34) CFSTI: HC $3.00/MF $0.75

Experimental investigations of gases at high temperatures conducted by shock-tube techniques are reviewed. The 24 papers include studies of various aspects of gas dynamics, such as experimental techniques and test facilities, plasma properties and plasma motion, various phenomena associated with waves in a shock tube, reflection and attenuation of shock waves, heat fluxes, density fields, boundary layer–reflected shock wave interactions, afterglow, and flows in chemically reacting media at high temperatures. Author

N65-23849# North Carolina State Coll., Raleigh. Dept. of Chemical Engineering
A STUDY OF CONVECTION BOILING INSIDE CHANNELS Progress Report, Oct. 1–Dec. 31, 1964

J. K. Ferrell 31 Dec. 1964 34 p refs
(Contract AT(40-1)-2950)

Vapor void data and static pressure difference measurements from uniformly heated smooth-bore, 0.466-inch inside diameter stainless steel tube were evaluated for slip ratio and pressure drop, respectively. A method of correlating vapor fraction based on volume and mass flow as functions of pressure, flow rate, and heat flux was successfully used to determine the slip ratio between the vapor and liquid phases in the heated channel. It was assumed that the slip ratio is (1) independent of true quality, (2) independent of heat flux, (3) dependent upon pressure, and (4) dependent upon liquid flow rate. A local two phase friction factor for pressure drop in a boiling channel was calculated by numerically differentiating the multiplier curve by eliminating the effect of the vapor void fraction data scatter. The results are presented in tables and show that the magnitude of this friction factor increases with decreasing heat flux and with decreasing flow rate. G.G.

N65-23870# European Atomic Energy Community, Brussels (Belgium).
SURVEY ON PROBLEMS IN THE FIELD OF NUCLEATE BOILING AND FILM BOILING [GRUNDZUGE DER PROBLEME AUF DEM GEBIET DER BLASEN- UND FILMVERDAMPFUNG]
H. Herkenrath and P. Moerk-Moerkenstein 1964 60 p refs In GERMAN; ENGLISH summary
(EUR-2211.d) Available from Belg. Am. Bank and Trust Co., New York Account No. 22.186: 50 Belg. fr.

A survey of the research in the field of nucleate boiling and film boiling is given. A clear distinction is made between the processes occurring in pool boiling and forced convection boiling. The various kinds of flow patterns associated with the boiling process are discussed in detail. A summary is presented of the most important empirical and theoretical relations for the critical heat flux. Author

N65-23888# Midwest Research Inst., Kansas City, Mo.
MASS SPECTROMETER STUDY OF METAL CONTAINING FLAMES Ninth Quarterly Technical Summary Report, 1 Oct.–31 Dec. 1963
Thomas A. Milne and Frank T. Greene [1963] 12 p refs
(Contract Nonr-3599(00); ARPA Order 23-62)
(AD-429892)

The aerodynamic molecular beam sampling system was applied to the quantitative study of stable product equilibria in CH_4–O_2–argon flames. Temperature measurements by sodium line reversal are also discussed. A simple modulated beam detection system for the mass spectrometer was constructed. Author

N65-23892# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Munich (West Germany). Institut für Flugtreib- und Schmierstoffe
ON SOME CORRELATIONS BETWEEN BURNING CHARACTERISTICS AND CHEMICAL CONSTITUTION OF FUELS FOR AIR-BREATHING JET PROPULSION UNITS [UBER EINIGE ZUSMMENHANGE ZWISCHEN BRENNVERHALTEN UND CHEMISCHER KONSTITUTION VON KRAFTS OFFEN FUR LUFTATMENDE TRIEBWERKE]
G. Spengler, H. Wolff, and H. Gemperlein Dec. 1964 39 p refs In GERMAN; ENGLISH summary
(DLR-FB-64-36) Available from ZLDI, Munich: 13.70 DM

This paper reports on investigations regarding the burning characteristics of fuels of different constitution. The arrangement of the test stand, the measuring method, and the calibration of the small-scale combustion chamber are described. The operation ranges of combustion chambers are discussed. The actual combustion tests indicate a distinct correlation between combustion rate and constitution of fuel, temperature of air entering the combustion chamber, and injection pressure. The influence of soot formation on the rate of combustion is investigated. Author

N65-23926*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HEAT-TRANSFER MEASUREMENTS OF A 0.0667-SCALE MODEL OF THE X-15 AIRPLANE FOR AN ANGLE-OF-ATTACK RANGE OF 0° TO 28° AT MACH NUMBERS OF 2.88 AND 4.65
Earl A. Price, Jr., Nancy L. Taylor, and Paige B. Burbank Washington, NASA, Jun. 1963 142 p refs
(NASA-TM-X-821) CFSTI: HC $4.00/MF $1.00 (Declassified)

Heat-transfer measurements were obtained on a 0.0667-scale model of the X-15 airplane for angles of yaw of ±10° and an angle-of-attack range of 0° to 20° at a Mach number of 2.88 and 0° to 28° at a Mach number of 4.65. These measurements were obtained over a free-stream Reynolds number range of 2.1×10^6 to 5.5×10^6 per foot. A complete tabulation of the experimental heating rates and a comparison of the heating rates on the basic components with simple theories are presented. Author

N65-23939 Aeronautical Research Council (Gt. Brit.)
MEASUREMENT OF AERODYNAMIC HEAT TRANSFER IN INTERMITTENT WIND-TUNNELS
A. Naysmith London, Min. of Aviation, Jan. 1964 24 p refs Supersedes RAE-TN-AERO-2942, ARC-25839
(ARC-CP-780; RAE-TN-AERO-2942; ARC-25839) HMSO: 4s 6d

The transient technique of measurement of aerodynamic heat transfer is described, and major sources of error are investigated. Methods of testing recommended allow errors to be corrected or avoided, and graphs given facilitate estimation of errors. Author

N65-23965# Sud-Aviation, Paris (France).
OUTLINE OF METHODS AND DATA REQUIRED FOR HEAT SHIELD CALCULATIONS
George Mounis [1964] 31 p Presented at Eurospace Conf., Brussels, 23–24 Jan. 1964

Computation methods in thermokinetics, data relating to heating conditions, and data relating to thermal properties of protective coating materials are investigated. Methods and data required for various heat shield designs for structural engineering of aerodynamic spacecraft are outlined. Analytical, semianalytical, analog, and numerical finite difference methods are discussed. R.C.S.

N65-23975# Royal Aircraft Establishment, Farnborough (England).
THE EXPERIMENTAL MEASUREMENT OF THE ABSORPTION CAPACITY OF AIR BEHIND THE FRONT OF A SHOCK WAVE [EKSPERIMENTAL'NOE IZMERENIE POGLOSHCHATEL'NOI SPOSOBNOSTI VOZDUKHA ZA FRONTOM UDARNOI VOLNY]

S. A. Losev and N. A. Generalov London, Min. of Aviation, Dec. 1964 7 p ref Transl. into ENGLISH from Fiz. Probl. Spektroskopii (Leningrad), v. 1, 4–12 Jul. 1960 p 114–116 (RAE-LIB-TRANS-1086)

The absorption capacity of air at a pressure of 1 atm and heated to temperature between 2500° and 4000° K in a 2-inch diameter shock tube was measured in a narrow wavelength region near 2200 Å by absorption spectroscopy. It is shown that at this wavelength and at a temperature of 3600° K, the absorption is mainly in the Schumann–Runge O_2 bands and is not due to NO; this result makes the study of O_2 dissociation behind shock wave in air possible. Author

N65-24009# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
FINITE ACOUSTIC OSCILLATIONS AND EROSIVE BURNING IN SOLID FUEL ROCKETS
J. F. Bird, R. W. Hart, and F. T. Mc Clure Feb. 1965 42 p refs
(Contract NOw-62-0604-c)
(TG-335-16; AD-461992)

The acoustic combustion instability of a solid-fuel rocket depends vitally on the response of the burning propellant surface to a sound field. The erosive part of this response can be significantly nonlinear at sound amplitudes too low in typical motors for ordinary second-order acoustic nonlinearities to be important. A unified summary of acoustic erosion contributions to stability is given. Other effects of nonlinear erosivity are analyzed. It is shown that erosive generation of harmonics can produce considerable waveform distortion of moderate amplitude axial modes. Also it is found that the nonlinear erosion mechanism can lead to severe oscillations, with consequent sharp mean pressure peaks, at rocket geometries where two acoustic modes are degenerate. This theory of nonlinear erosive interactions of a mode with itself, with its harmonics, and with degenerate modes seems to agree qualitatively with various experimental observations. Author

N65-24013*# Pratt and Whitney Aircraft, East Hartford, Conn.
ANALYTICAL STUDY OF LIQUID METAL CONDENSING INSIDE TUBES
H. R. Kunz Jan. 1965 88 p refs
(Contract NAS3-2335)
(NASA-CR-54352; PWA-2530) CFSTI: HC $3.00/MF $0.75

An analysis is presented of annular, two-phase flow inside of circular tubes. This analysis enables an estimation of the liquid film thickness for one- or two-component flow and the heat transfer coefficient for condensing flow of a pure fluid. Special consideration is given to condensing liquid metals. Results obtained using this analysis were found to be in good agreement with measured values of liquid film thickness in vertical upflow and downflow for air–water mixtures in annular adiabatic flow. Similarly, condensing heat transfer coefficients calculated for vertical downflow of steam were found to be in good agreement with measurements. Finally, results of sample calculations are presented for condensing potassium. In the analytical approach, all liquid is considered to be flowing in an annular film along the tube wall with no liquid entrainment in the vapor core. Shear stress and heat flux distributions are derived for the liquid film and are combined with empirical expressions for turbulent diffusion coefficients and wall shear stress to enable calculation of the liquid velocity and temperature profiles. The expressions for turbulent diffusion coefficients are obtained from data for fully developed single-phase pipe flow. The velocity and temperature profiles enable the liquid film thickness and condensing heat transfer coefficients to be determined. Author

N65-24097# Witwatersrand Univ., Johannesburg (South Africa). Dept. of Mechanical Engineering
THE DETERMINATION OF LAMINAR BURNING VELOCITY WITH PARTICULAR REFERENCE TO THE CONSTANT VOLUME METHOD. PART 2: APPARATUS
C. J. Rallis, A. M. Garforth, and J. A. Steinz Jan. 1965 73 p refs
(Rept.-25)

This report lays down requirements of the apparatus necessary for the satisfactory application of the constant volume method. It describes, in some detail, an apparatus which yields reproducible results. Author

N65-24208# Naval Ordnance Lab., White Oak, Md.
MEASUREMENTS AND CORRELATION OF HEAT TRANSFER IN A SOLID PROPELLANT ROCKET NOZZLE Final Report
Roland E. Lee Apr. 1965 50 p refs
(NOLTR-64-163)

The two-dimensional transient heat flow in a conical De Laval nozzle subject to a solid propellant exhaust flow was investigated. Local temperature and heat transfer rates at the internal surface were determined from a combined experimental and analytical method. It was found that an analysis assuming one-dimensional heat flow gave essentially the same results as the two-dimensional analysis. Local heat transfer coefficients were compared with the predictions from a detailed solution of the turbulent boundary layer flow and with the widely used empirical relation of Bartz. The present results were in better agreement with the boundary layer solution, particularly in the prediction of the peak value at the nozzle throat. The present rocket nozzle data expressed in Nusselt number form showed very good agreement with the steady-state heat transfer data observed with a water-cooled copper nozzle. On the basis of the present data plus the copper nozzle data a simple adjustment is derived to include the effects of compressibility and geometry in the conventional Nusselt–Reynolds number correlation. This adjustment decreases the scatter of experimental data by 43%.
Author

N65-24226# Sandia Corp., Albuquerque, N. Mex.
DRAG COEFFICIENTS AND HEATING RATIOS FOR RIGHT CIRCULAR CYLINDERS IN FREE-MOLECULAR AND CONTINUUM FLOW FROM MACH 10 TO 30
Robert D. Klett Dec. 1964 40 p refs
(SC-RR-64-2141)

Methods are presented for calculating drag coefficients and average heating ratios for lift–drag ratios up to 20, and Mach numbers from 10 to 30. The cases of end-on, side-on, end-over-end tumbling, and random tumbling are covered for free-molecular and laminar continuum flow. Author

N65-24263# Technische Hogeschool, Delft (Netherlands). Laboratorium voor Verbrandingsmotoren en Gasturbines
A STUDY OF THE HEAT EXCHANGER IN GAS TURBINE TECHNOLOGY
B. D. Marcus 10 Apr. 1964 75 p refs Work performed in cooperation with TNO
(Rept.-10.J.013)

The following aspects of gas turbine heat exchangers are considered: (1) the numerous types commonly used, according to their functions; (2) the fundamental heat transfer, fluid flow, and thermodynamic principles involved, and their systematic application to the design of superior heat exchangers; (3) the various classes of heat exchanger designs available, according to their operating principles, and the technological

criteria which must be considered in choosing a particular design for a particular gas turbine application; (4) a review of current practice in gas turbine heat exchangers including performance figures achieved; (5) a review of some primary areas of endeavor in current heat exchanger research and development including suggestions for future work. Author

N65-24299*# Bellcomm, Inc., Washington, D. C.
A DESCRIPTION OF HYPERSONIC LAMINAR HEAT TRANSFER AT THE STAGNATION POINT OF A BLUNT BODY—CASE 110
J. S. Dohnanyi 10 Sep. 1964 83 p refs
(NASA-CR-62848) CFSTI: HC $1.00/MF $0.50

The basic concepts involved in the stagnation point convective heat transfer for a blunt body moving at hypersonic velocity are discussed. Calculational procedures are outlined in detail using the heat transfer parameter $N_u/\sqrt{R_e}$ as the basic quantity of reference. The most recent theories are briefly reviewed; they agree with each other to within ±25% and are in good agreement with experiment. Since the experimental points scatter over a range of ±50% (i.e., a factor of two) and since all the theoretical curves for the heat transfer parameter fall within this range, it is not possible to prefer one theory to any of the others, on the basis of experimental evidence alone. Fay and Kemp use the most recent transport properties in their calculations and obtain conservative results while a not-so-recent calculation by Hoshizaki (used by NAA for design criteria) predicts heat transfer parameters about 30% lower in the velocity range of 20000 to 35000 ft/sec. Therefore, because of existing uncertainties, Hoshizaki's method may underestimate the stagnation point heating rates by as much as 30% at Apollo-type reentry conditions. Author

N65-24313# California Univ., Livermore. Lawrence Radiation Lab.
EQUATION OF STATE. A SURVEY OF THE THERMODYNAMIC PROPERTIES OF MATTER AT HIGH PRESSURES AND TEMPERATURES
Stephen G. Brush 12 Jun. 1964 194 p refs
(Contract W-7405-ENG-48)
(UCRL-7437)

Thermodynamic properties of matter for temperature-density regions in which various kinds of equations of state are relevant, and a survey of theoretical methods for calculating the equations of state are given. The temperature-density regions considered are: (a) low-temperature–low-density region, (b) high-temperature–high-density region, (c) low-temperature–high-density region, and (d) high-temperature–low-density region. A thermodynamic description of high pressure states is given. R.C.S.

N65-24316# Sandia Corp., Albuquerque, N. Mex.
AN APPROXIMATE SOLUTION FOR THE VAPORIZATION OF LIQUID DROPLETS FORMED DURING REENTRY ABLATION Aerospace Nuclear Safety Research Report
R. N. Horton Apr. 1965 20 p refs
(SC-RR-65-138) CFSTI: $2.00

A mathematical model is described which will help solve the ultimate-particle-size problems by estimating the evaporative mass losses during that portion of reentry when the fuel is in liquid form. An iterative solution is necessary to solve the equations governing the aerodynamic heating, transient-heat transfer, and evaporative mass loss in order to arrive at the ultimate particle size. Since this type of problem lends itself readily to a computer solution, the final form of the equations in this report are written in a manner which can be easily programed on virtually any computer. A computer program was written, and a small computer was used to conduct a vaporization analysis on a particular isotopic fuel form. This analysis will serve as a sample calculation for this report. Author

N65-24328# Toronto Univ. (Ontario). Inst. for Aerospace Studies
ANALOGUE NETWORKS FOR HIGH HEAT-TRANSFER RATE MEASUREMENTS
Z. A. Walenta Nov. 1964 61 p refs
(Grant AF-AFOSR-365-64)
(UTIAS-TN-84; AFOSR-65-0261)

An automatic correction circuit developed for use with thin-film heat-transfer gages and analog networks has been successfully tested. Such a correction circuit is essential when the gage temperature becomes high enough to cause changes in the gage properties, thereby introducing nonlinear effects. The circuit has been tested in a 4-in. × 7-in. hypersonic shock tube at shock Mach numbers where ionization was negligible. Agreement was obtained between theory and corrected experimental data up to rises in gage temperatures of 75° C. Useful theoretical corrections were also obtained. Author

N65-24379*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GEOMETRIC SHAPE FACTORS FOR PLANETARY-THERMAL AND PLANETARY-REFLECTED RADIATION INCIDENT UPON SPINNING AND NONSPINNING SPACECRAFT
Lenwood G. Clark and E. Clay Anderson Washington, NASA, May 1965 55 p refs
(NASA-TN-D-2835) CFSTI: HC $3.00/MF $0.50

Truncated series expressions are obtained for the planetary-thermal and planetary-reflected solar radiation incident upon arbitrarily oriented spinning and nonspinning spacecraft. For the spinning case, spacecraft having the angular momentum vector either normal to or coincident with the axis of symmetry are considered. Results are presented in graphical form for planar surfaces and bodies of revolution as a function of spacecraft attitude and altitude. Results for the spinning case are obtained by averaging instantaneous values over a spin period and are sufficiently accurate for most spinning spacecraft. Expressions for obtaining the spacecraft's attitude in terms of orbit parameters for the solar-oriented case are included. Author

N65-24384*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VAPOR PRESSURE OF SODIUM FROM 0.5 TO 120 ATMOSPHERES
Kenneth J. Bowles and Louis Rosenblum Washington, NASA, May 1965 12 p refs
(NASA-TN-D-2849) CFSTI: HC $1.00/MF $0.50

The vapor pressure of sodium was measured by a static capsule method from 0.5 to 120 atmospheres. An equation, $\log p = 4.51961 - \frac{5202.12}{T}$, where p is pressure in atmospheres and T is temperature in °K, was fitted to the data with a standard deviation in p of 3.2 percent. This equation was pooled with equations determined in three previous independent studies. The pooled equation, $\log p_p = 4.54025 - \frac{5242.11}{T}$, probably offers the most accurate representation of the vapor pressure of sodium from 0.5 to 120 atmospheres. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N65-23363# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 175
29 Apr. 1965 71 p refs Transl. into ENGLISH from K'o Hsueh T'ung Pao (Peking), no. 3, 17 Mar. 1965
(JPRS-29821; TT-65-30851) CFSTI: $3.00

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1. DEVELOPMENT OF THE SCIENCE OF SILT Tsung-tai Fang and Ch'ien Ning p 1–5
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N65-23368# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 173
21 Apr. 1965 29 p Transl. into ENGLISH from Chinese Periodicals
(JPRS-29702; TT-65-30794) CFSTI: $2.00

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N65-23432# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 1, NUMBER 5
May 1965 72 p refs

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6. MANY-IMPULSE OPTIMAL PLANE TRANSFERS IN A HOMOGENEOUS CENTRAL GRAVITATIONAL FIELD L. Kacinskas p 30–33 refs (See N65-23437 13-30)
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10. SCIENCE PERSONALITIES p 61–62 refs
11. BOOK REVIEWS p 63–68

N65-23490# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Dokumentation und Zentralbibliothek
GENERAL BIBLIOGRAPHY, PART I, 1912–1945 [GESAMT-BIBLIOGRAPHIE, TEIL I, 1912–1945]
Klaus Laisiepen, comp. [1962] 89 p refs In GERMAN

N65-23499*# National Aeronautics and Space Administration, Washington, D. C.
[UNIVERSITIES IN THE SOUTHERN CRESCENT AND SPACE-RELATED PROGRAMS] News Release
James E. Webb 15 May 1965 19 p Presented at the Meeting of the Univ. of Ala. Alumni, 15 May 1965 Available from the Scientific and Technical Information Division

James E. Webb, Administrator, National Aeronautics and Space Administration, discusses the whole industrial evolution of the southern states which is linked to space technology, and points out three areas in which southern states can make a contribution to American industrial life: higher education, reestablishment and dramatization of individual craftsmanship, and management concepts of business. The extension of the substantial federal investment benefits into other aspects of the southern community will depend upon the vision and the resourcefulness of the respective civic and business leaders. G.G.

N65-23721# Joint Publications Research Service, Washington, D. C.
THE USE OF ELECTRON BEAMS AND LASERS IN INDUSTRY
4 May 1965 19 p Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), no. 1, Jan. 1965 p 25–29, 37–41
(JPRS-29917; TT-65-30906) CFSTI: $1.00

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1. THE ELECTRON BEAM IN MODERN VACUUM METALLURGY B. Ye. Paton and B. A. Movchan p 1–8 (See N65-23722 13-34)
2. THE INDUSTRIAL POSSIBILITIES OF LASERS V. S. Zuyev p 9–16 (See N65-23723 13-16)

N65-23722 Joint Publications Research Service, Washington, D. C.
THE ELECTRON BEAM IN MODERN VACUUM METALLURGY
B. Ye. Paton and B. A. Movchan *In its* The Use of Electron Beams and Laser in Ind. 4 May 1965 p 1–8 (See N65-23721 13-34)

The basic features of the electron beam heat source in connection with a high vacuum are considered for their metallurgical applications. Axial irradiation units and radial electron beam heaters are widely used in electron beam melting for obtaining pure niobium, tantalum, and many alloys based on these metals, as well as for refining and improving the properties of molybdenum, hafnium, zirconium, cobalt, nickel, iron, and copper. Electron beam refining of the indicated metals and their alloys lowers their hardness more than double and sharply increases their plasticity. It is concluded that the present electron beam melting in a vacuum of 10^{-4} to 10^{-5} mm Hg can be extended to a higher vacuum, thus inducing a higher degree of refining. G.G.

N65-23781*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ASTRIONICS RESEARCH AND DEVELOPMENT Report No. 3, Jan. 1–Dec. 31, 1964
Hubert E. Kroh, comp. and Jeanene Flowers, ed. 1 Mar. 1965 103 p refs
(NASA-TM-X-53217) CFSTI: HC $4.00/MF $0.75

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1. INTRODUCTION TO THE KALMAN-SCHMIDT FILTER John W. Kenelly and Kenneth S. Williamsom p 1–8 refs (See N65-23782 13-08)

2. A MATHEMATICAL METHOD TO DETERMINE THE ATTITUDE OF A SPHERE Hans F. Kennel p 9–19 (See N65-23783 13-19)

3. DEVELOPMENT OF SQUEEZE FILM BEARINGS Peter H. Broussard, Jr., John Burch, and Emmett L. Martz p 20–30 refs (See N65-23784 13-15)

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5. REAL TIME ANALOG COMPUTER SIMULATION OF THE ELASTIC SPACE VEHICLE INVOLVING BEAM CELL TRANSMISSION MATRICES George L. von Pragenau p 42–54 refs (See N65-23786 13-32)

6. CONSTRUCTION OF ELASTIC BODY MODELS FROM SATURN DYNAMIC TEST RESULTS John H. George and Maurice E. Singley p 55–61 refs (See N65-23787 13-32)

7. SIGNAL CONDITIONING CIRCUIT FOR AN OSCILLOSCOPE DISPLAY OF BENDING Charles P. Elms p 62–65 refs (See N65-23788 13-14)

8. SIMULATION OF FLEXIBLE BODY DYNAMICS BEHAVIOR Glen D. Ritter p 66–71 refs (See N65-23789 13-32)

9. A PROPELLANT SLOSH MEASURING SYSTEM FOR SPACE VEHICLES B. G. Bynum and John F. Hamlet p 72–77 (See N65-23790 13-14)

10. AN EMERGENCY HELIUM BUBBLING CONTROL SYSTEM FOR THE PREVENTION OF GEYSERING IN THE LOX SUCTION LINES OF S-IC James A. Power and A. Turel p 78–86 (See N65-23791 13-03)

11. AN UP-CONVERTER/DOWN-CONVERTER METHOD OF DATA TRANSMISSION Edmund H. Gleason p 87–91 (See N65-23792 13-07)

N65-23836# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 1, NUMBER 4
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(AD-460286) CFSTI: HC $3.00/MF $0.75

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2. COMBUSTION INSTABILITY IN LIQUID-ROCKET AND AIR-BREATHING PROPULSION SYSTEMS Paul Vantoch p 14–23 refs (See N65-23838 13-33)

3. RECENT SOVIET EXPERIMENTAL STUDIES ON GAS DYNAMICS AND PROPERTIES OF GASES AT HIGH TEMPERATURES Alexis Baratoff p 24–28 refs (See N65-23839 13-33)

4. MORPHOLOGICAL FORMS IN HIGH POLYMERS Boris Ofrossimow p 29–40 refs (See N65-23840 13-18)

N65-23854# Union Carbide Nuclear Co., Oak Ridge, Tenn.
AN APPLICATION OF CRITICAL PATH SCHEDULING TO DESIGN ENGINEERING (SANS COMPUTER)
J. H. Boyd, Jr. (M.S. Thesis–Tennessee Univ.) 1 Mar. 1965 105 p refs
(Contract W-7405-ENG-26)
(Y-1480) CFSTI: $4.00

A method is presented for the planning and scheduling of design engineering projects by applying the fundamentals of critical path scheduling, sans computer. An actual case history is used, and the detailed mechanics of installing the project on critical path is presented. This method is suitable for design engineering organizations that range in size up to 200 engineers and draftsmen. The experience of 2 1/2 years of applying critical path scheduling to design engineering projects is summarized. Author

N65-23967# Martin Co., Baltimore, Md.
PRINCIPLES OF INTERFACE MANAGEMENT IN ADVANCED PROJECTS
Carl Kober Paris, Eurospace, [1964] 29 p Presented at the U.S.–European Conf., Rome, 22–24 Jun. 1964

The evolution of systems procurement management from the early laboratory system to the current interface management concept is discussed, with emphasis on the control of interfaces between the associate and the participating government agencies in a given system development program. This interface management concept uses the building block idea to replace the concurrency concept. Complete program definitions include standardized specifications, time/cost information, and the schedules interface logistics which ensures complete interface control and excellent configuration control. G.G.

N65-23968# Eurospace, Paris (France).
PROCEEDINGS OF THE U. S.–EUROPEAN CONFERENCE HELD IN ROME ON THE 22–24 JUNE 1964
[1964] 47 p

Six papers on management which were presented by U.S. speakers are reported. Topics included *The Integration Tools of System Management*, focusing on the Minuteman system; *Cost Effectiveness in a Development Programme*, focusing on cost effectiveness as used to compare the performance of one program to another and as a decision making aid within existing programs, and the use of this concept in the Saturn program; *Testing of Booster Upper Stages*, focusing on the

Agena vehicle; *Reliability and Environmental Testing of Spacecraft*, focusing on the selection of the correct level of reliability and the amount of testing required to attain this level; *Principles of Interface Management in Advanced Projects*, focusing on Syncom, Advanced Syncom, and Early Bird. Each paper contains a discussion in which comments of European speakers are included. Also included in the report is a list of papers available at EUROSPACE. S.C.W.

N65-23971# Boeing Co., Seattle, Wash.
THE INTEGRATION TOOLS OF SYSTEM MANAGEMENT
H. K. Hebeler Paris, Eurospace, [1964] 46 p Presented at the U.S.–European Conf., Rome, 22–24 Jun. 1964

Discussed are the major tools of system management which relate to the integration of the work of one contractor with the work of another, with emphasis in the areas of work and time management. These tools are initiated and reviewed by pure management organizations, and actually detailed and completed by the functional organizations. Integration tools of work management consist of event logic networks for work definition; program plans for agreement on how work will be done; systems requirements analysis for identifying and quantifying equipment, manning, and procedures; and interface control for responsibility assignment to insure compatible mating hardware. Integration tools of system schedule management consist of establishing schedules; keeping track of progress; and taking corrective action in system management. G.G.

N65-24030# Douglas Aircraft Co., Inc., Santa Monica, Calif.
COST EFFECTIVENESS IN A DEVELOPMENT PROGRAMME
T. J. Gordon [1964] 14 p ref Presented at the US–European Conf., Rome, 22–24 Jun. 1964

Discussed is the extension of the cost effectiveness approach, as used to indicate the dollar efficiency of accomplishing particular space missions, to the comparison of charges within a single inbeing program. The cost effectiveness of the basic unimproved vehicle is defined as

$$(CE)_B = \frac{C}{P_L}$$

where C is the total cost in dollars of the next vehicle to be launched, and P_L is the vehicle's payload potential. This particular vehicle is overweight. The potential solutions of (1) removing weight, or (2) increasing engine thrust is expressed by

$$(CE)_i = \frac{C+\Delta C}{P_L+\Delta P_L}$$

where Δ is the incremental cost of the change and ΔP_L is the payload benefit. The established ratio can be adapted to the effects of variations in reliability between the modifications being considered. G.G.

N65-24125*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AERO-ASTRODYNAMICS RESEARCH AND DEVELOPMENT RESEARCH REVIEW NO. 1, JANUARY 1–JUNE 30, 1964
1 Oct. 1964 147 p refs
(NASA-TM-X-53189) CFSTI: HC $4.00/MF $1.00

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3. WALL PRESSURE FLUCTUATIONS AND SKIN VIBRATIONS WITH EMPHASIS ON FREE SHEAR LAYERS AND OSCILLATING SHOCKS F. R. Krause p 18–32 refs (See N65-24128 13-32)

4. ON AN EXTENSION OF OSWATITSCH'S EQUIVALENCE RULE TO UNSTEADY FLOW M. F. Platzer p 33–43 refs (See N65-24129 13-12)

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6. NONLINEAR TWO-DEGREES-OF-FREEDOM RESPONSE WITH SINUSOIDAL INPUTS Robert S. Ryan p 54–62 refs

7. A SIMPLE METHOD FOR DETERMINING THE BENDING MOMENT EQUATION THAT INCLUDES VEHICLE ELASTIC AND SLOSHING MODES AND A NUMERICAL EXAMPLE R. S. Ryan, F. Swift, and D. Townsend p 63–68 (See N65-24131 13-32)

8. ON TRANSIENT RESPONSE OF A MULTISTAGE SPACE VEHICLE F. C. Liu p 69–73 refs (See N65-24132 13-32)

9. NONLINEAR VIBRATION OF BEAMS F. C. Liu p 74–79 refs (See N65-24133 13-32)

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18. PUBLICATIONS AND PRESENTATIONS P 125–141

N65-24211# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences
THEORY OF GROWTH: REMODELLING AND REFINEMENTS
Michio Morishima 12 Apr. 1965 60 p refs
(Contract Nonr-225(50))
(TR-132; AD-614252)

When all the factors of production are produced in the system and capitalists' consumption is allowed, the existence of the Golden Equilibrium (or the von Neumann equilibrium) can be proved even with a weak Malthusian assumption. The equilibrium turns out to be a state of instantaneous efficiency as well as a temporary Pareto optimum. However, its intertemporal efficiency and optimality do not necessarily follow. If all goods and labor are provided at the beginning in

positive amounts without the limitational factor being specified, then all efficient paths defined in terms of the final stages converge on the turnpike in the broad sense that the average output per man over T periods of each goods approximates the turnpike output per man when T tends to infinity. The consumption turnpike theorem is discussed on the assumption that society maximizes the utility that depends on the discounted average of consumption streams and the population stream. Author

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